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THE SCHOOL OF SALERNO *

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There was a time when the first centuries of the Middle Ages were considered as an epoch in which Christian Europe, wasted by wars and epidemics, invaded by barbarians, had preserved nothing but the remembrance of past greatness. At that time also the belief was current that in the early Middle Ages Greek and Latin civilisation had been entirely submerged, and that it was not until the beginning of the Renaissance that first a slow and then a steady growth of the old seed took place. It seemed that with the decline of Roman civilisation medical thought also had suffered, and that it regained its power only under the new influence of Arabic culture on Western Europe. But the most accurate and careful historical studies have made it evident that in reality the tradition of wisdom was not extinguished even in the darkest centuries, even when ancient civilisation had been overthrown and when the conquerors had changed the political order and had destroyed the monuments of ancient greatness. To be sure, the progress in literature, in science, in art, in customs had been arrested; the Christian faith, spreading rapidly, had changed the trend of thought in literature and research. The conquering Goths and Longobardi, who by force of arms had reduced to bondage a great part of Southern Italy, trampled upon the blossoms, yet they did not destroy the roots. Ancient tradition

* The following article is the English version of a paper read by the author before a general audience.

awakened and came to life again, first in the countries which had been saved from the invasion and had preserved their civilisation under the nominal domination of the Eastern Empire, later in Rome which had become the capital of Christianity, and in Venice, defended by its lagoons. When the fever of war had passed, the invaders themselves began to take on the customs of the conquered, and bowed to the moral strength and grandeur of Latin civilisation. Theodoric affirmed: *delectamur iure Romano vivere*, we are happy to live according to Roman law; and Cassiodorus, his great minister, recommending a Gaul to the Roman Senate, carefully wrote of him that, having lived in Italy, his habits were no longer barbaric, but were truly Roman.

The foreign rulers in Italy, as becomes clear for instance from the decrees of Theodoric concerning the establishment of well organised medical corporations, realized the necessity of regulating the practice of medicine according to Roman conceptions. The same spiritual strength which had mitigated the severity of Longobardic laws, drawing them into the orbit of Rome, the same ancient tradition which was reborn in art and in philosophy, was revived in medicine. When wars were raging, when Rome was a prey to corruption and at the mercy of the barbarians and when the end of the empire was imminent, philosophy assumed the forms of mysticism and later of Catholic Neo-Platonism. Medicine, which traced its origin to the same sources, now became restricted to literary pursuits in the shadow of the cloisters.

Numerous documents prove that in Western Europe during the Middle Ages there were some lay practitioners with the same titles as the physicians in Roman times, and, besides, clerics who practised the art of medicine. The form rather than the essence of old Roman medicine survived with the lay practitioners who were mediocre philosophers rather than good physicians. The clerics, on the other hand, practised a form of mysticism rendering assistance to the soul rather than to the body, a form of charity according to which the priest is the interpreter of the divine will, and of that healing power which is the essential attribute of the divinity.

Thus again, medicine became priestly, as it was with the people of Israel, and as it must logically be in a people dominated by a

theocratic conception. But in the Christendom of the Middle Ages it became priestly by virtue of the canonical books, of the works of the Holy Church Fathers, and of the Healing Saints; a medicine of divine grace and of miracles, inspired by charity and faith, but not accountable by criticism and research. In such an epoch the study of ancient writers could not suffice to awaken the spirit of science. For in the 6th century A. D., when long and ferocious strife between Ostrogoths and Byzantines broke out, when all Italy was troubled by plagues and famine, study was almost exclusively reserved to the clerics; only the Roman church in its venerable power was able to offer a safe asylum to scholars.

It was then in the monasteries that literary medicine as well as philosophical studies took refuge. But for another reason also medicine at this time was monastic, for it was around the cloisters that hospitals developed. Only the monks could find the peace and serenity necessary for the work of assistance to the sick during these constant bloody feuds and fratricidal wars. Only members of religious orders could compel that respect which, imposed upon men of all factions, even the most violent, impelled them to lay down their weapons at the door of the cloister, a respect which alone secured the repose of the sick and the possibility of quietly attending to their care. These men then who had been led to embrace the monastic rule of sacrifice and renunciation, by their pure faith and by the knowledge of human miseries, were the first and most ready to approach those stricken with pestilence and leprosy and to help the wounded. It was thus that monastic medicine became important in the Middle Ages and later on developed greatly in certain orders of knighthood, such as the Knights of St. John and the Templars.

In 529 A. D., the same year in which the philosophical school at Athens was definitely closed, St. Benedict founded Monte Cassino, and prescribed that a hospital for the sick should be near the cloister, ordering the abbot to take care of it most diligently. Medical manuscripts preserved in the valuable library show that medicine was taught according to the writings of Hippocrates and Galen. Some time after the founding of Monte Cassino, Cassiodorus retired from public life to the cloister, which he himself had founded in Squillace, and to which he had brought a rich collection of old manu-

scripts. Being well acquainted with ancient literature, he admonished the brethren to study the virtues of simples and the composition of drugs, although he believed that only with God can there be hope. The great philosopher, who had been minister to Theodoric, and, long before Charlemagne, had founded public schools, recommended the study of Dioscorides and of the classical Greek authors on medicine. Like St. Augustine and Boethius, inspired by the immortal thinkers of antiquity, he linked together Christian medicine and Christian philosophy with Greek and Roman thought.

Monte Cassino became an important center of studies in which medicine had a considerable part; at the end of the 9th century A. D. the cloister was widely renowned for its cures, and the sick came there from all parts of Europe. Moreover, from the old convent the doctrine and the work of St. Benedict soon spread to numerous newly founded monasteries near which hospitals, foundling-houses, and asylums were established by the monks. Another center of studies developed in the farthest region of Western Europe, in Ireland, where Christianity had been diffused by the work of St. Patrick. In the cloisters, founded on the green isle by mystics and ascetics who were bound by the most severe discipline, the knowledge of Greek was preserved, and the old classical books were studied. These Irish monks, again, were the founders of other monasteries which became very famous, like that of St. Gall, well-known for its medical studies, or that of Bobbio near Pavia, which was equal to Monte Cassino in its devotion to learned literature.

In Italy as well as in Ireland the monks vied with each other in writing books, and gradually there was produced a whole monastic literature. Among these clerical writings, treatises called *Horti* or *Orti*, which contained descriptions of herbs most frequently cultivated in the gardens of the convents, were numerous, for the knowledge of medical plants was the basis of therapeutics at that time. Monastic medicine, which spread over the whole of Europe, thus gave rise to a new type of medical writing. Apart from the description of simples, however, it was mostly concerned with the prescription of dietetics; hygienic regulations were only occasionally mentioned.

Lay medicine, which had survived especially in Southern Italy

and in some schools of Southern France, tended to become merely empirical; few lay practitioners knew Latin, or were concerned with study. Medical literature, therefore, was exclusively the province of clerics, who dealt with its literary and philosophical aspects rather than with its scientific implications. There is no indication to be found in the monastic medical literature of this time, that quotations from Hippocrates, Galen, or from other classical authors were used other than for recommending certain prescriptions. The knowledge of ancient texts, therefore, did not enhance scientific progress, and the development of both monastic and lay medicine seems to have been arrested at a very primitive stage around 1000 A. D. The practice of medicine consisted of the use of hygienic and dietetic prescriptions, and treatment comprising almost exclusively bloodletting, and the application of purgatives and sudorifics, supported by a courageous and faithful assistance to the sick which was related, however, more to the dictates of Christianity than to the needs of the patient.

Yet during this epoch a new ardor for studies also revealed itself, first in Italy, later in all Western Europe, and, what is more important, the interest in intellectual problems spread also among laymen. This spiritual movement was inspired not only by the monasteries but also by the influence of Arabic culture, through the great Arabic thinkers, mathematicians, philosophers and physicians. This was the time when the Italian towns regained their civil liberty, and when the Latin tradition was revived; it was the time of the itinerant clerics of whom it was said: *pro Marco legunt Flaccum, pro Paulo Virgilium*, they loved to read Horace instead of St. Mark, and Virgil instead of St. Paul. The rule of the Othos who remained far from Italy did not impede the development of commerce or the general movement of Christendom towards Rome. The contacts with foreign countries, the universal knowledge of Latin among scholars and priests all over the world, led to a revival of traditions which had never completely disappeared and also resulted in a definite renaissance of medical thought.

The history of the lay school of Salerno gives a clear picture of the confluence of the different trends of thought, especially of the two most important ones: the teaching of the empirical schools of

Southern Italy and the powerful influence of monastic erudition. These two trends were clearly in opposition, for the former was characterised by the Greek and Roman freedom of research and by a spirit of critical observation; the latter, the scholastic dogmatism, was inspired by faith but enlightened by an ample literary erudition. Yet both these trends and others of less importance which were instigated by the new relation between the Orient and the Northern countries, gradually developed into a perfect union in the Salernitan school.

The town of Salerno, built on a pleasant bay, had already been considered by the old Roman physicians as an ideal retreat for the sick and was situated in a country where the struggle between peoples of different races and civilisations had always been most vehement. From ancient times, the sick came to Salerno, enjoying the benefits of the climate and delighting in the wonderful scenery. But Salerno was also the *Civitas Hippocratica*, the most famous health-resort of the Middle Ages; it was only natural that here, as early as the 7th century A. D., a hospital was founded by the Benedictines. While clerics practised medicine in the hospital of the convent, lay practitioners, who were free from all ecclesiastical bonds, also attended the sick. Strong behind its castles and its walls, the city was a center of Mediterranean life; it had preserved the old civilisation and was, even before becoming the seat of an independent principality, the most important town of Southern Italy.

The school of Salerno, at first, was an empirical school, which like many others in the Middle Ages centered around the most celebrated physicians. Accounts of some old Salernitan chroniclers attributed its foundation to four teachers: a Jew by the name of Helinus or Elysaeus who lectured in Hebrew to the Jewish scholars, a magister Pontus who taught the Greeks in Greek, a magister Abdalah or Adela, who being an Arab, gave his classes in Arabic, and finally a magister Salernus who lectured in Latin. This account evidently is no more than a legend, yet in its simplicity it is of particular significance. It indicates first of all that the Salernitan school from the beginning was accessible to students of all nations, of all languages and of all religions; furthermore, it shows that Salerno never had the character of a school which was restricted to clerics.

The exact date of the foundation of the school is not known, but we may assume that it was founded around 900 A. D. In 904 A. D. a physician at the court of France boasted of having been a student of the Salernitan school and in 984 A. D. Alberon, Bishop of Verdun, came to ask the advice of the Salernitan masters whose art was sought by secular and ecclesiastical princes.

From a modest beginning, closely related to the old Benedictine cloister, the Salernitan school rapidly developed and freed itself from all clerical influence. About 1000 A. D. its teaching was of a purely lay character. Ten physicians formed the college which derived its name from Hippocrates. The college proved to be worthy of his name and prepared and published the regulations of the school. The ten colleagues enjoyed particular privileges and special grants; students of all nationalities, among them a great number of Jews, frequented the classes. The medical writings of the first period of the school, i. e. approximately between the 9th and 11th centuries A. D., were decidedly influenced by Greek and Roman thought. Although the books in general are not unlike those of the mediaeval monastic literature, although some of the teachers were still clerics occupying important positions in the ecclesiastical hierarchy, as for instance Alfanus I, who later became Archbishop of Salerno, yet the book "*De Quattuor Humoribus*," on the Four Humours, shows clearly that Salernitan medicine of this time faithfully followed the precepts of the classical Greek writers. Fragments of Greek or Latin texts were preserved in this literature, evidently in their original form; therapeutics were dealt with from a purely medical point of view, without any suggestion of magic, astrology, religion, or mysticism. All these treatises showed a profound reverence for Hippocrates who, in the work of Gariopontus, the most famous master of the school, was referred to as *omnium peritissimus*, the most skillful of all. The work which is entitled "*Passionarius*" clearly shows the general tendency of the school which was secular in so far as all Greek words were Latinised and often translated into the vernacular, and which was Hellenic in so far as the books of Galen, Priscianus, Alexander of Tralles and Paul of Aegina were used for the compilation of this encyclopedic compendium.

During this first period of the school there was no noticeable

Arabic influence, but rather a practical trend which might properly be called clinical. The books of this time were chiefly handbooks for students, containing directions for the practitioner. One of them which deserves mention deals with the diseases of women before, during, and after accouchement. The writer of this book, which is probably a late compilation, was believed to be a woman physician named Trotula who lived at Salerno. Even by her contemporaries she was spoken of as *mulier sapientissima*, and she is the well-known " Dame Trot " who still survives in the English chap-books. In the work of this wise woman the regulations given for the selection of wet nurses, for whom a special diet eliminating all highly seasoned food is prescribed, are particularly noteworthy. The existence of such a book and the fact that there was a woman physician in the Salernitan school gives additional confirmation of the practical and lay character of the school in its first period.

The contribution of the Jews to this school, as to all important cultural centers in the Mediterranean, was very remarkable. As early as the 7th century A. D. important Jewish communities flourished in Venice, Rome, Milan, and Genoa. There were Jewish settlements also in many partly Saracenic towns, such as Oria and Otranto, and in the neighborhood of Salerno. The Jews were valuable collaborators in the Salernitan medical studies since, being more subject to the influence of the Arabs whose language they understood and by whom they were amicably treated, they had more ready access to Arabic medicine. One of the Jewish chroniclers of the period between 860 and 1060 A. D., Achimaaz, born in Capua not far from Salerno, apparently had close contact with the Orient; he was proud of his friendship with Al-Mansur, who reigned in Egypt towards the end of the 10th century A. D. These Jewish scholars certainly spoke Greek and Arabic in addition to Hebrew, and were probably the first to prepare the way for Arabic ideas to penetrate into Southern Italy.

The Arabic influence is characteristic of the new period of the Salernitan school which began at the end of the 11th century A. D. In 1075 Robert Guiscard conquered Salerno and adorned the town with great magnificence, making it the capital of his realm. His reign was certainly one of the most brilliant periods in Salernitan

history, for Robert was an intelligent and cultured man. Foreign trade increased; all institutions reached their highest development.

Salernitan medicine of this epoch was dominated by one of the most interesting figures in the history of mediaeval medicine, Constantine the African, a physician and scientist, a learned and assiduous translator. It is likely that he came to Salerno from Sicily where the Arabs had been predominant for 250 years. Born in Carthage, he had travelled widely, as far as Babylon, where he had devoted himself to studies in mathematics, astronomy, necromancy and music. In addition he is said to have gone to Ethiopia and Egypt and to have spent a long time in India where he became acquainted with the art of the Indians. As one of his enthusiastic biographers reports, he returned to Carthage after having spent forty years in study. From thence he escaped to Sicily, then to Salerno, where he was received by Robert Guiscard. He became a celebrated teacher and was held in great esteem by the duke, yet after some years he entered the order of the Benedictines and went to Monte Cassino where Desiderius, the Longobard, was abbot. The latter, a man of great culture who afterwards became Pope Victor III, was the author of a treatise on medicine. Constantine spent the last years of his life in Monte Cassino working and translating constantly; he died in 1087 A. D.

We find in Constantine a type of the erudite man frequently encountered also in Italian literature of the 15th century, a type who was well versed in oriental languages and was remarkably active in translating ancient texts, with more ingenuity, however, than fidelity. Falsifications, as is well known today, had been very frequent in the early Middle Ages. Yet Constantine was so ignorant of the importance of giving faithfully the names of the authors and exact information regarding their works, that the impression sometimes prevails that he translated everything that came to hand without discriminating between unusual but true occurrences and those accounts that were merely the result of fantastic imagination. He translated something of everything from the writings of a variety of authors and periods, often forgetting to put authors' names so that in many cases the work of others, voluntarily or involuntarily, is made to pass for his own. But, apart from this diffused opus, it

was his great merit to have brought to Italy and to have translated not only some important Arabic authors but also the Aphorisms of Hippocrates, the *Ars parva* of Galen and Galen's commentary on the Aphorisms. I do not agree with those historians who state that Constantine's influence changed the character of the Salernitan school completely. But it was without doubt primarily owing to the work of this man, who still in the late Middle Ages was known under the name of *Magister Orientis et Occidentis*, that Arabic authors were first introduced into the Salernitan school at the beginning of the 12th century A. D. Thus Salerno later became the center of the Graeco-Arabic scholastic medicine from which the whole of mediaeval medical literature of Western Europe is derived.

In Salerno then, in the first important lay school arising after the decay of Latinism, Greek and Arabic medicine were fused. As far as culture in general was concerned such a fusion had already been achieved in Sicily where on a soil impregnated with Hellenic influences under Arabic domination new schools had been established and grand and noble works of art had been created. As far as medicine was concerned, the fusion occurred in Salerno; and it seems very interesting to me that it was achieved by an erudite monk in the shadow of an old cloister. If we attempt to reconstruct the history of medical thought in the Salernitan school, we realize that the old legend of the four masters, speaking different tongues and coming from different countries to found this school, has symbolic significance. Each of the masters represents one of the trends of thought which were to be combined in the Salernitan doctrine.

In the process of time, the school became more and more scientific in character; it is here for the first time perhaps that we see the development of scientific medicine from empirical practice and literary study. For it was in Salerno that the anatomy of the internal organs and the limbs of vertebrates, such as swine and monkeys, was first taught by dissecting these animals. Hitherto anatomy had been taught in a perfectly typical and conventional manner exclusively from old texts with the help of some few Alexandrian drawings of ancient origin, whereas in the monastic schools anatomy had not been taught at all. In Salerno it became a part of the regular curriculum of medical studies.

Surgery, moreover, made the greatest progress at the same time. Roger of Salerno was the author of the famous book "*Post Mundi Fabricam*," thus called from its opening words, the outstanding surgical book of Western Europe for more than two centuries. Roger was original in his research; apparently without any knowledge of the great Arabic surgeon Albucasis, he became the founder of a new type of surgery. Although following in its main principles the tradition of the great Byzantines, he boldly freed surgery from the bonds which the late Greek authors and the Christian church had imposed upon it. In contrast to the Arabs this new Salernitan surgery admitted and prescribed some daring interventions. It probably originated from the empirical surgery as generally performed in Southern Italy by practitioners such as the so-called Masters of Norcia and the members of the Branca family, men who operated skillfully even in difficult cases and were particularly expert in rhinoplastics. Was there any relation between those practical surgeons of Lower Italy and those of India who for centuries had performed the same operations, the secret of this surgical art being handed down in India as in Italy from father to son through generations? This problem is difficult to solve; at any rate the close analogy between facts occurring at periods and places so far removed from one another leads us to believe that certain relations existed between these heterogeneous and distant peoples. Yet this assumption can hardly be proved.

The surgery of Roger extensively treats of the wounds of the skull and indicates the suitable surgical intervention when the brain is injured; it gives instructions for the differential diagnosis of the lesions of bones and distinguishes the cases in which it seems advisable to trephine. The technique of trephining is also described accurately. In case of depressed fractures he advises that a series of little holes should be made with the trephine making it possible to raise bony fragments without damage to the meninges.

The indications for the treatment of wounds of the intestine and of the peritoneum are also noteworthy for their originality. If the viscera are protruding and have been exposed to the air for some time so that they have become cold, he advises that the abdomen of an animal should be opened and placed on the injured part, allowing

it to remain there until the injured intestine becomes warm and soft. Afterwards the bowels are to be cleansed slowly with a sponge, well washed and soaked with warm water; then replaced in the abdomen leaving the wound open until the normal functioning of the intestine can be observed. The medication is prescribed exactly: a lint is to be introduced into the edges of the wound to permit drainage; the bandage must be changed every day.

Of no less importance are the exact instructions in Roger's prescriptions for the treatment of fractures and dislocations of the limbs. Furthermore all the operations of classical surgery such as lithotomy, the operation for hernia and for hydrocele are described precisely, while some pages are devoted to interesting diagnostic observations, as for instance to the differential diagnosis of stones in the bladder and prostatic hypertrophy. The surgical treatment of cancer of the rectum and of the uterus is pronounced possible but not advisable on account of the great danger and the few favorable results of the operation.

A commentary on the " Surgery of Roger " written by Rolando da Parma, one of Roger's most renowned pupils who lived and practised in Bologna about 1200, was widely read. It was first published in Venice in 1498 together with the commentary of another renowned surgeon, Guy de Chauliac, physician to the Popes in Avignon and a great enemy of Petrarch. There is a wonderful manuscript of these commentaries preserved in the Biblioteca Casanatense in Rome which was written in the 13th century and was beautifully illuminated with miniatures; this manuscript was reproduced in a fine edition by Carbonelli in 1927. Both the text and the colorful drawings show clearly how far Salernitan surgery had advanced. The manuscript also contains a list of surgical instruments used at that time: large and small trephines, the scalpel, the scraper, different forms of forceps and needles, lead-plates for stitching, dilatators for the draining of wounds. The position in which the patient is placed during the operation for hernia is that which is known today as the Trendelenburg position.

These bold Salernitan surgeons, ever ready to operate if necessary, introduced the principle which animated the work of the great surgeons of the 13th century and inspired the masters who first pre-

scribed the simple treatment of wounds without medicaments, affirming that suppuration was not necessary. From the Salernitan school went a number of brilliant surgeons who throughout the Middle Ages held leading positions in Italy as well as in France, where from Lanfranco to Guidi they were the outstanding figures of French surgery.

The Salernitan surgery of Roger also gave rise to a vast and important literature. The most remarkable work of this kind was the so-called " Book of the Four Masters," again a commentary on the surgery of Roger, written by four Salernitan physicians named Arcimatheus, Petroncellus, Platearius and Ferrarius. Sudhoff assumes that this book may have been written at a much later date, yet it was certainly inspired by Roger, the greatest authority and the famous master of surgery whose work marked one of the most important epochs in the history of this art. This Salernitan surgeon, of whose life nothing is definitely known and whose name is uncertain, was a man of great capacity, skillful and confident in his surgical technique.

Compared with the great progress in surgery at Salerno, therapy and pathology had not yet advanced much beyond the teachings of the Hippocratic school. Therapy, as we learn from numerous books of simples which belonged to the literature of this time, faithfully adhered to the treatments and remedies as prescribed by the Hippocratic and Byzantine authors. Nor does symptomatology seem to have made much progress. The discussion of fevers, their origin and character are precisely the same as those of the late Greek writers. We notice, however, a new spirit of research, a method of exact empirical observation. The part which treats of pulmonary diseases is noteworthy for some original diagnostic and prognostic remarks concerning phthisis. Of special interest is the comment on haemoptysis, which at the beginning of the disease is considered as a favorable sign.

Salernitan pathology, however, of which the most important part is collected in the book " *De aegritudinum curatione*," containing the doctrines of the seven Salernitan masters, certainly does not represent what we should now call an original study on the subject. Yet we find in it accurate observations on physiology, correct ideas

of pathology and diagnostics, and it is evident that the author was a physician accustomed to work at the bedside of the sick. There are pages in Salernitan literature in which the picture of disease is clearly and accurately presented, and compared with monastic medicine, certainly demonstrate enormous progress. This progress was due to that spirit which was characteristic of Greek medicine and later, through Greek influence, of Arabic medicine.

Salerno, in the epoch of its greatest achievements, influenced the Christian world in different ways. In Salernitan medicine Hippocratic thought was reborn, that is, the method of direct clinical observation which is independent of external influence. Salerno established titles for physicians, rules for the profession and created a new professional ethics inspired by the Hippocratic writings. Salernitan medicine for the first time in history shows the accomplishments of a complete, well organized lay school in which there was freedom of teaching and freedom of research. The students no longer learned a few chapters of medicine or a few cases of diseases from their teachers as in the Alexandrian schools, nor was the teaching merely practical as it was in the Arabic schools. Salernitan anatomy was taught on the cadaver. Pathology, although based on the doctrine of the humours, yet showed a tendency towards new conceptions. Diagnostics depended upon an exact examination of the pulse and upon uroscopy. Medicine slowly detached itself from scholastic ideas. For the first time the problem of sensibility and its alterations was mentioned; the conception of a dynamic function of life was advanced. The aetiology of fevers was critically studied for the first time and the Galenic conception and treatment of putrid fevers was overthrown. Thanks to this school, handbooks for students appeared for the first time, prescribing exactly the behaviour of the physician in the different diseases, giving advice, sometimes with irony, and with keen insight, as expressed in the famous sentence: "An expensive remedy often helps the patient, but a free remedy will certainly be useless." While surgery improved greatly, other branches of medicine began to be developed, above all ophthalmology. Benvenuto Grapheo was doubtless the most famous oculist of the Middle Ages and his "*Practica Oculorum*," copied in a great number of manuscripts and translated into many languages, was for some centuries the classical textbook of ophthalmology.

The Salernitan school began to decline at the end of the 13th century. Although it still enjoyed universal renown, as is evidenced by the fact that Ladislaus, king of Hungary, granted special privileges to the doctors of Salerno in 1413, the importance of the school decreased and its literary production almost ceased. Other great medical schools arose at that time: first Bologna, then Paris, Padua and Montpellier, the last of which resembled the school of Salerno most as far as the type of teaching was concerned; they were similar also in that the Arabic and Jewish influence was manifest in both; Montpellier and Salerno both were near the centers of Arabic culture, which was transmitted to Salerno from Sicily and to Montpellier from Spain. Egide de Corbeil, a Salernitan scholar, became a teacher at Montpellier and sang the praises of his old school in a poem on medicine.

The period of the *Civitas Hippocratica*, a brilliant phase in the history of Mediterranean culture, is closely connected with the development of thought in the early universities. In Salerno Arabic medicine had been accepted without hesitation; it had come in contact with Greek, Byzantine and monastic medicine. The school itself reached its climax in the reign of Frederick II, king of Sicily, a talented and cultured prince, who invited to his court in Palermo philosophers, scholars, and men of letters, patronised the translation of scientific works of the Arabs, and attempted to diffuse the knowledge of Aristotle's writings as translated from Arabic into Latin, copies of which he sent to the most important universities of Western Europe. Born in Italy, a Greek by education and taste, he had abandoned feudalism and returned to the principles of Roman law; he defended freedom of thought against popes like Gregory IX and Innocent IV. Charles I of Anjou continued these traditions, seeking translators and collecting their works as treasures. Although these translations from Greek into Arabic, from Arabic into Hebrew and from Hebrew into Latin were often inexact, sometimes even full of errors, they were nevertheless important. At the time when Western Christianity was preparing for the great enterprise of the Crusades, to drive the Moslems out of the Holy Land, Western Europe received from Toledo the writings of Aristotle and the Almagest of Ptolemy; the books of Avicenna, Rhazes,

Averroes, and Maimonides were widely distributed in Italy. This Arabic influence which meant a rebellion against scholastic medicine found its way into the universities, particularly into Padua, and thus became a decisive impulse to the renaissance of medicine.

When the names of the Salernitan masters were forgotten, when Salerno was no longer the center of medical knowledge in Western Europe, when the sick no longer flocked to its sunny shores from all parts of Europe, there still remained in the medical history of the Renaissance the influence of the magnificent and complex work of the first Western lay school, so distinctly Mediterranean in its origin and its development. The figures of the great Salernitan teachers stand out against the gray background of mediaeval life, because they were animated by their freedom of thought, energy and enthusiasm for research. Like the school of Cos, Salerno was founded near a sanctuary; as in Cos, the physicians were taught to be conscious of the dignity of their task; they learned the fundamental precepts of clinical observation at the bedside of the patient. And even today, when reading those simple readily memorized Latin verses in which the practical teaching of the school is summarized, verses which thousands of doctors of all times have read, learned and repeated, verses which were translated into many languages and printed in many hundreds of editions, one realizes the wisdom of the great mediaeval scholars who preserved tradition and yet courageously opened the way to the great discoveries of the medicine of the Renaissance.

A SKETCH OF THE HISTORY OF GYNECOLOGY AND OBSTETRICS IN TURKEY

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There are many old books, manuscripts and documents that can be used to reconstruct the development of medicine in Turkey. Old surgical instruments, remains of old medical buildings and centers, are actual links in a long chain of evidence that vividly brings to mind the gradual evolution of present day methods and technics. It is not my purpose to present a complete history of medicine in Turkey. We shall briefly summarize the development of gynecology and obstetrics from its earliest beginnings down to its present level of scientific accuracy.

That there is a history of medicine in Turkey can be easily established. In the XVIIth century Şemseddin from Şirvan (1622-1648) wrote an illustrated book of Anatomy, in the pure Turkish language, "Teşrihul Ebdan," or "Anatomy of the Body." Long before Şemseddin, "Avicenna," or, in Turkish "Ibni Sina," the great Turkish physician and philosopher wrote his "Canon of Medicine" at the beginning of the XIth century. Avicenna, was born in Buhara in 980 A. D. Until recently he was generally believed to have been an Arabian; but a recent study published by the Institute of Medical History of the University of Istanbul conclusively proves the pure Turkish origins of this great figure in medical history. Figure 1 shows Avicenna examining a neurasthenic patient over nine hundred years ago.

Modern scholars at the Institute of Medical History in Istanbul have collected a long series of former popular medical beliefs in Turkey. These practices originated among the common people and constitute the "Folklore" of medical history. Some of their primitive beliefs in obstetrics are crude but amusing.

We shall cite a few examples of these beliefs of the Old Turks which are highly interesting medically and in some cases also very amusing. For the purpose of clarity we shall group these primitive obstetrical beliefs under five general headings: 1. general ideas

concerning pregnancy: 2. approximate fetal sex determination; 3. course and handling of labor; 4. care of the new-born; 5. post-natal care and puerperal infection.

Pregnancy: In order to be sure of an intelligent and nice baby, a pregnant woman was advised to eat pomegranates, but to be very

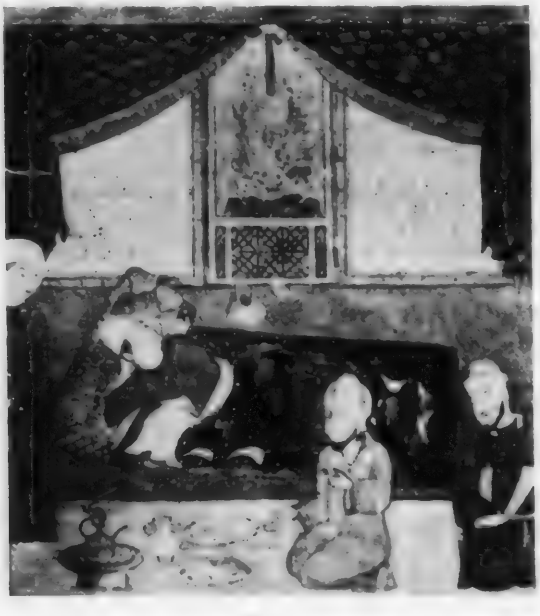

Fig. 1.

Avicenna, Buhara (980-1037). This picture was published in 1937 to commemorate the 900th anniversary of his death. The ceremony took place at the University of Istanbul. The picture is adopted from "Çehar Makale," which is written by Nizamii Aruzi from Semerkant in Herat 1431 A. D. The book is exquisitely gilted and it is in the Türk-Islam Museum no. T. 418, in Istanbul.

In this figure Avicenna is examining a patient who has fallen in love, and the patient is the cousin of Emir Kabus Vesmegir, the ruler of Rey and Tabaristan.

careful not to fall down on any of its seeds. The mother was advised to swallow some pepper grains during the first three months of pregnancy so that her baby would be born with a mole.

Fetal Sex Determination: A drop of colostrum from the mother was put on the top of a glass of water. If the drop sank to the

bottom, that signified a heavy fetus, a solid character in the child, one who would remain at home later on, consequently a boy. If the drop remained on the surface, it signified a light fetus, and by the same reasoning, a light character in the child, one who would not remain at home, consequently a girl. Another method was to study the diet of the mother. If she liked to eat sweet things, she would have a boy; if she preferred sour foods, the child would be a girl. Excessive pigmentation on the face and nipples during pregnancy indicated a girl; light pigmentation, a boy.

Another test: wheat and barley were put into separate containers and urine from the pregnant mother was poured into each. If the wheat sprouted a few days later, the child would be a girl; in case the barley had sprouted, a boy would be the result.

Delivery: In the old days, people preferred midwives, especially those who were known to have had much secret training. The midwife always carried in her bag a small piece of wood called the "Hand of Mary, the Virgin Mother." The belief was that this would insure a painless and easy delivery as that of the Mother of Jesus. During the delivery, all the ladies of the household would stand around the mother and speak as loudly as possible. In case of a delay in delivery, a gun was shot off to frighten the mother and hasten the labor.

After the delivery they cut the cord, washed the baby, sprinkled some salt on him, wrapped him in some clothes and placed him in his father's arms. They then sat down to a large dinner. This was called the dinner of the Blessed Virgin Mary.

In case of asphyxia in the new-born, they immediately cut the cord, poured some of the resulting blood on the body of the baby, threw the placenta into the fire, and made the baby smell an onion.

Post-natal and Puerperal Infection: The baby was usually given a daily bath for forty days, otherwise, pustules would form, called the "forty days disease." In case the mother were not a primipara and the other babies were not living, the newly born child would not be washed for a long time.

On the seventh day after the birth of the child they held another ceremony. They would place sweets on the lips of the baby and at the same time wish that he might become an educated and agreeable person.

After the delivery the mother would not visit or have contact with any other babies for forty days, in order to prevent her own child from contracting disease. To make sure that the baby would be quiet, the placenta was kept in the room for 24 hours.

When the baby started to talk he was given mostly calf and lamb meat to eat, because these were considered particularly efficient for the development of speech.

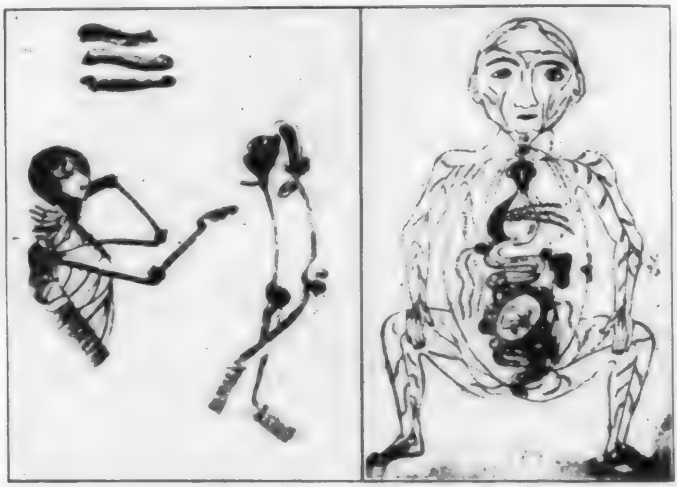

Fig. 2.

From the "Anatomy of the Body" by Şemseddin from Şirvan (1622-1648). (Sülemaniye-Vehbi efendi, Eyup Hüsrev paşa, and University libraries, and in the History of Medicine Institute. Each one has one copy.)

If puerperal infections set in, fairies and devils were blamed. Treatment of this was chiefly psychological and necromancy. If the evil spirits could be driven out, the woman would be cured.

The "Anatomy of the Body" written by Şemseddin the XVIIth century contains fairly accurate drawings of the abdominal cavity, the thorax, blood vessels; in one picture the fetus is well marked, the skeletons are nicely delineated. (Figure 2).

Figure 3 is a scene of a delivery in a Turkish house in Istanbul at the end of the XVIIIth century. It presents the picture of a normal delivery; the midwife is helping, the head is delivered, the

woman is seated on a delivery chair, the ladies of the household are holding her and conversing together in pairs at the same time.

Fig. 3.

At the end of the eighteenth century a scene of a Turkish home delivery in Istanbul. This picture is adopted from the book called "Hubanname and Zenanname," which is in the University Library Museum.

When the case became complicated, a surgeon was called. Figure 4, although a miniature, is full of meaning and illustrates just such a case (11th century). It shows the scene in the delivery room immediately after the surgeon has performed a Caesarean section.

Such operations were practiced from early days in the East. The Oriental used to believe that the only men of a promising future were born with great difficulty and by means of Caesarean section. It was a common practice of the authors of fiction in the East to have their heroes born in this manner. A story by the Persian poet "Rüstem, son of Zal," contains a good description of the Caesarean birth of the hero. Across the upper part of the picture in Figure 4, are some lines of old Turkish poetry, which explain the Caesarean operation. Modern Turkish uses Roman letters.

As medical thought gradually advanced in Europe and developed more and more exact in its methods, so also newer and more scientific medical ideas in Turkey gradually supplanted all the primitive, superstitious notions and practices. The rebirth of an interest in scientific study and methods in Europe towards the end of the 18th century was not without having its effects on Turkey. As the study of anatomy and physiology became of prime importance in the teaching of medicine, King Mahmut II founded a medical school in 1827, according to the newly discovered principles. Foreign teachers were imported, and since the majority of them were French, the French language was adopted for teaching in the school. In time it became evident that the study of medicine in French for students was not satisfactory. A group of young doctors translated the French and Austrian texts and then taught the courses in Turkish with great success. Dr. Aziz Krimi was the chief among the pioneers of this movement.

Dr. Waichno, was the first one to teach gynecology and obstetrics in the Medical School of Istanbul. His assistant Dr. Vahit succeeded him. One of the pioneers in teaching medicine in Turkish Dr. Mehmet Nuri, translated the 5th edition of Pinard's obstetrical works. Other editions by Dr. Ziya Nuri were translated; physicians and midwives were excellently trained. After Dr. Vahit retired, Prof. Besim Ömer took his place following a post-graduate course in the Budin Clinic in France (1891).

About this time a public Gynecological and Obstetrical Dispensary for the examination of patients was opened in Istanbul. The principles of asepsis and antisepsis, however, were not as yet accepted as fundamental at the clinics.

Dr. Gen. Hayrettin, a famous surgeon in those days, would per-

form Caesarean sections on the marble table in the bathroom of the medical school in Sarayburnu (about 1885).

The question of asepsis and antisepsis was finally settled about 1891. Dr. Gen. Cemil Topuzlu took a post-graduate course in Europe and returned to Turkey with the latest European ideas on

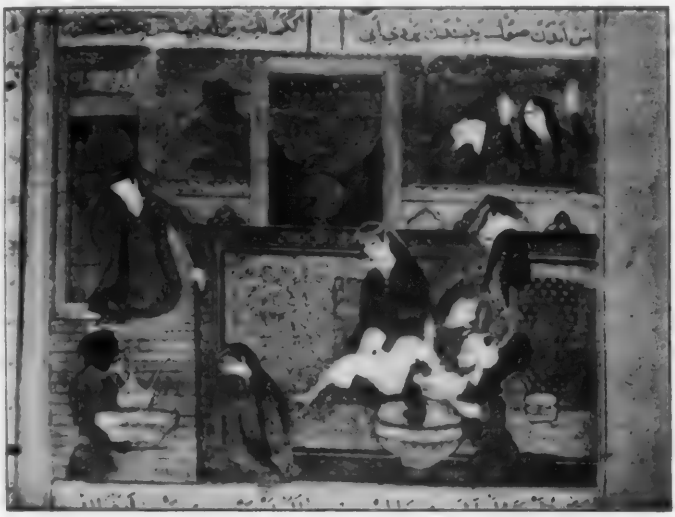

Fig. 4.

Caesarean section in the Orient in Olden Times. The picture is adopted from "Şehname" written in Turkish, which is now in the Treasure Library in Topkapi palace, Istanbul. It is an expressive scene.

this question (1890). Dr. Gen. Cemil also founded a general surgical clinic in Istanbul, where operations, some gynecological cases, were performed under aseptic conditions (1891).

In 1905 the medical school was transferred to a large and beautiful building on the Asiatic coast of Istanbul. This school was known as the "Medical Faculty"; another one in Damascus in Ottoman Empire time offered courses chiefly for the under-graduate students.

About four years ago the Medical Faculty was again transferred back to the European part of the city as part of a complete reorganization of the University and city hospitals.

With the introduction of aseptic methods about 1891, the need for a well-organized post-graduate medical school became evident. Dr. Rieder and Dr. Deyke from Germany founded an excellent school of this type in Istanbul on the European coast near the south entrance of the Bosphorus. Dr. Rieder was the first director of this Gülhane Post-Graduate Medical School, and Dr. Deyke was its first attendant. A group of young Turkish doctors was sent to Germany to do four or five years of post-graduate study, each in his own special field. As they returned, Dr. Rieder appointed each one, according to his specialties, to head a department of the hospital. The new hospital thus founded, began to work according to Western methods in 1902.

One of this group of Turkish doctors, Dr. Asaf Derviş (1869-1928) trained for four years in a German clinic under Olshausen. He became the first professor of gynecology and obstetrics, and was appointed Chief of the Gynecological and Obstetrical Clinic. Since 1902, specialists of this department have been recognized in the country.

The senior gynecologist and obstetricians at the present time are the former students of Dr. Derviş (Professor Refik Münür Keskin, Prof. Kenan Tevrik, and Prof. Fuat Fehim, etc.)

Four or six years are required to finish the post-graduate course of the Gülhane Medical School. Every year sees increasing numbers of specialists enrolling and completing their courses.

We are indeed grateful to Dr. Rieder and Dr. Deyke for their work in founding this Institution.

We wish to thank Prof. Süheyl Ünver for his courtesy in allowing us to publish his illustrations.

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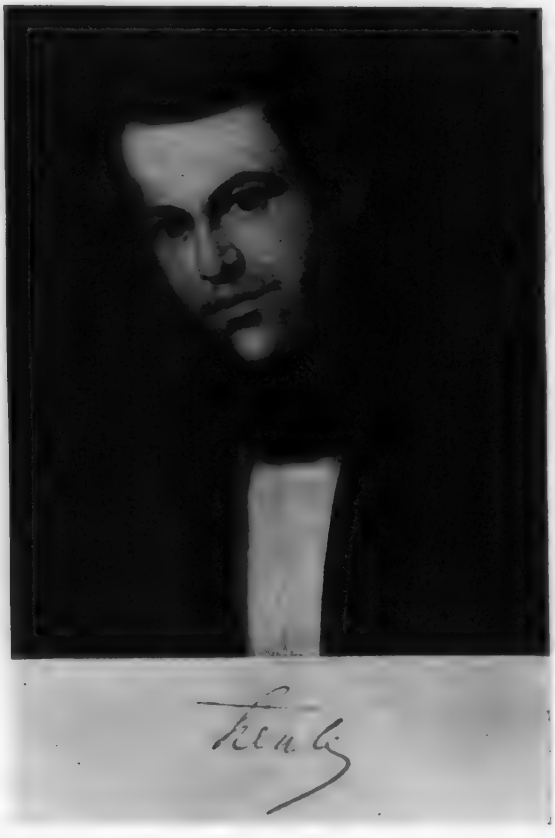

JACOB HENLE (1809-1895)

UNIV. OF MICH.

TEXTS AND DOCUMENTS

JACOB HENLE: ON MIASMATA AND CONTAGIA

TRANSLATED BY
GEORGE ROSEN, M. D.

INTRODUCTION

A little less than one hundred years ago—in 1840—the "Pathologische Untersuchungen" of Jacob Henle was published in Berlin. This work, whose author was then 31 years old and had just entered upon his duties as professor of Anatomy at Zürich, is a landmark in the history of medicine in general and of infectious diseases in particular. It possesses this significance because of the first paper contained in the volume and entitled *Von den Miasmen und Kontagien,* Concerning Miasmata and Contagia. However, unlike other important medical contributions, this paper does not contain a single new discovery. Its significance lies in the fact that in this essay Henle formulated, on the basis of deductive considerations, his firm conviction that Contagia Animata, i. e. living organisms were the cause of contagious and infectious diseases.

Some of the facts upon which Henle based his theory were known long before his time. Traces of the theory may be found in antiquity. Pliny expressed the opinion that swamp fever was due to the entrance of extremely small organisms into the body. The Arabs apparently were acquainted with the parasitic nature of scabies. In the seventeenth century Athanasius Kircher and Leeuwenhoek had seen infusoria and other living microscopic creatures. In 1786 a Hannoverian physician Joh. Ernst Wichmann described the itchmite which causes scabies. Agostino Bassi in 1837 found the muscardine of silkworms to be due to plant parasites. At about the same time Cagniard de la Tour and Schwann showed that fermentation was due to the action of small organisms—yeast. A further contribution was made in the same year by the clinician Johann Lukas Schönlein, who discovered the parasite of Favus to be a fungus.

Henle, as I have already mentioned, did not base his theory on any experiments of his own but rather on data which had been gathered by numerous observers. On the basis of this considerable material, Henle, by means of logical and cogent arguments, erected and advocated the theory that contagious and infectious diseases were the result of living microscopic organisms; he further indicated the principles upon which experimental proof of his ideas would be based. It is interesting to note that Henle was very catholic in his choice of data and ranged from veterinary medicine to fetal pathology.

Henle's discussion and convictions may be summarized as follows: In cases of infectious diseases the morbid matter apparently increases from the moment it enters the body, leading to the conclusion that it must be organic in nature since only living organisms have such faculties. The fact that a certain period of incubation usually precedes the outbreak of the disease also supports this conclusion. Having thus made it logically plausible, that the causative factor in infectious diseases is a living organism, the nature of the as yet unknown parasite must be considered, and here Henle, basing his theoretical considerations on the observations of Bassi and Audouin, who, in their researches on the muscardine—an infectious disease of the silkworms, had found the cause to be a fungus, comes to the conclusion that it is very likely a member of the plant kingdom.

Henle's conclusions were still extremely hypothetical but in this very fact lies the significance of his contribution. He took the entire mass of partly conflicting and apparently unrelated data, sifted and analysed this material, and finally produced definite theoretical conclusions, which raised the entire problem to a higher level of development by pointing out the problems to be solved. The conditions which Henle postulated—constant existence of the parasite—created problems which were difficult to solve and it was not until more than thirty years later that one of his pupils, Robert Koch, was able to fulfill the conditions and furnish definite proof that Henle's theory was correct. Students of Koch's life and work have recognized that Henle's personality and ideas exerted a definite influence on his development as a scientist.

In this paper Henle discusses many single points which are of great interest. Such are his remarks concerning the extension of

tuberculosis from the lungs to the intestine and to other organs. His explanation of matastasis in neoplastic disease—the extension of tumor cells along blood and lymph vessels to other parts of the body—shows clearly that Henle was already thinking along the lines of cellular pathology 18 years before Virchow published his classic work.

In translating this paper, I have attempted to retain the author's style as far as possible. I have done this not only for the purpose of permitting the logical cogency of Henle's reasoning to speak for itself, but also in order that one of the factors, which in my opinion militated against the rapid acceptance of the theory presented, might become more apparent. The progress of material and mental technique has been a basic factor in the development of biological science. The role of material technique in this process is fairly well understood but that of mental technique is still to a large extent unexplored. Mental technique comprises terminology and conceptual structure. Very often these two categories are but two phases of the same entity; the terminology expresses or implies the concepts, which have been constructed to explain or describe categories of natural phenomena. The lack of a satisfactory terminology or of concepts with which the investigator can operate, can have the effect of retarding or even of bringing to a standstill the most promising advances.

I believe the importance of this factor in preventing the rapid acceptance of Henle's theory should not be underestimated. Upon reading his paper it soon becomes apparent that, in his attempt to construct concepts upon which future investigations could be based, Henle was hampered by the lack of a satisfactory terminology. The circumlocutory manner in which he expresses his ideas tends to cloud the logical clarity of his thought.

Like any other scientific achievement Henle's work must be judged in relation to its contemporary background. Appearing a year after the publication of Schwann's famous little book on the cell theory, it already contains a discussion of this new theory in relation to infectious diseases. The question of spontaneous generation—Generatio aequivoca—which at that time was still very actual, is also discussed by Henle, and, although he admits it as a possibility, he

expresses the desire to avoid it as long as possible. In these things Henle proves himself to be an open-minded scientist, but averse to any superfluous and unfounded speculation.

Henle lived to see the vindication of his ideas and the foundation of the science of bacteriology for which he had laid the theoretical foundation.

I wish to mention that the frontispiece is a copy of an original photograph in the possession of Dr. W. Pagel of Cambridge, England.

ON MIASMATA AND CONTAGIA

BY

JACOB HENLE

It sometimes happens, that a large number of individuals in a greater or smaller region suddenly fall ill at the same time and in the same manner. Such diseases are called epidemics or, if they are very widespread, pandemics.

One sees further, that in certain districts the individuals living there fall ill, one after another, in the same way; people, previously healthy, are attacked by the native disease when they go into such districts. Such diseases are called endemic.

Epidemic and endemic diseases are therefore those which affect a number of individuals simultaneously, the only difference being, that in epidemic diseases the causes of the disease seek out the individual, while in the endemic ones the causes of the disease, being bound to the locality, are sought by the individual.

Since epidemics and endemics attack the most diverse individuals, without having to assume a pathological predisposition, since a great number are attacked at the same time and in the same way, and since even epidemic diseases do not remain confined to one species, but very often epidemics and epizootics rage simultaneously, therefore their causes must be of the same nature, so that they may act simultaneously over wide stretches and in certain areas constantly, so that it is difficult to withdraw from their influence.

If one disregards certain customary modes of living, of clothing, etc., which may condition the peculiar disease types of certain peoples and regions, one will then look for the cause of epidemic and endemic diseases only in food, climatic conditions and in the effect of the atmosphere. Climatic conditions, act, as much as one knows with any certainty, only by way of the atmospheric constitution. The latter then, alone remains to be accused in all cases, where the

cause of the disease cannot be discovered in the food and beverages, whose nature is easier to examine.

The change in the atmosphere, by means of which it exerts its noxious action, are either physical or chemical.

The physical changes are those of the air currents, then also of tension and temperature, which lend themselves to expression by means of barometer and thermometer readings, and of electricity. We wish to add to these the hygrometric condition of the atmosphere. The close relation, in which these conditions stand to human and animal health, has been settled through thousandfold experience. One knows the action of high degrees of heat and cold and of the rapid changes of both; one knows the accidents, diseases or exacerbations of diseases which under certain atmospheric conditions—high barometer readings and the like—attack people with a pathological constitution. Often, however, the violence and fatality of epidemic cases of disease do not seem to be in any sort of relation to the change in the nature of the air, very often they last through all thermometer and barometer changes, and often, they show themselves to be very similar in the most diverse climates. When the migrations which some epidemics, and therefore also their causes within fixed limits, undertake, are added to these facts, when one finally considers the favorable action of chemical agents, which have been tried here and there for fumigation and vaporisation, against the disease-cause, then the physical changes of the atmosphere do not suffice for an explanation, and the supposition of a matter, which, mixed with and poisoning the air, may be transported, separated and destroyed, seems unavoidable.

The miasma i. e. that which contaminates, arose thus as a concept, and up to our time, it has remained little more than a concept, since it has neither been perceptively demonstrable through any of the aids to our senses,[1] nor do we know to which of the kingdoms of nature it belongs or whether it belongs at all to either of them. One would

[1] One should not confuse the miasmatic corruption of the air with that corruption arising from the removal of its respiratory elements. Neither restricted quantities of air, in which the respiration of many organisms has depleted the oxygen, nor the air of sewers and wells which contain carbonic acid are miasmatic, and do not produce miasmatic diseases.

not be able to say anything further about this being, without departing entirely from the basis of empiricism, were it not, that in certain properties and actions, it coincides with other disease producing potencies, thus demonstrating its identity with them. These latter, by which I mean the contagions, are to be sure, combined with a palpable substance, accessible to sentient observation and have already been in part physically demonstrated.

Among the number of diseases which are communicated by contagions, we know more than one, which, without any demonstrable contagion, develops in an epidemic manner. These diseases, which are simultaneously miasmatic and contagious, are said to arise miasmatically and to become contagious in their further course. Without previously subjecting the experiences upon which this view is based to criticism, I wish, from this point of view, to divide the endemic and epidemic diseases into three groups. The first consists of those which are only miasmatic and, as far as one knows, are never contagious. I include only the ague in this group. In the second group belong the diseases, which appear miasmatically, but apparently are also spread through contagions; such are the contagious exanthemata, small-pox, measles, rubella, scarlet fever; in addition typhoid, certain types of cold and catarrh, particularly influenza, dysentery, cholera, plague, and one form of puerperal fever. All these diseases are distinguished by their absolutely typical course, which, when the disease has once broken out, cannot by any expedient either be substantially accelerated or retarded, except that through a total alteration of the vital forces the development of the disease may be entirely checked. They are also characterized by a peculiar combination of fever and skin rash [2] of either the external or internal membranes. Only the plague seems to be an exception, since neither the carbuncles nor the petechial spots can be considered as a rash, and according to Bulard's [3] numerous recent observations, there is nothing constant among the internal pathological changes, except

[2] In a paper on the formation of mucus and pus (Berl. 1838, u. Hufelands Journ. May, 1838) I demonstrated the identity of the exanthemata with catarrhs and I showed that both are identical with the inflammatory process. To the facts mentioned there I may add that Häser has described a papular, rarely pustular rash of the pharyngeal and palatine mucosa in influenza. Allg. med. Ztg. 1837, Nr. 22.

[3] Caspers Wochenschrift 1838, Nr. 42.

for the degeneration of the lymph glands. I further wish to add to these, as more locally restricted types, the Egyptian inflammation of the eyes,* ophthalmia neonatorum and hospital gangrene. I only wish to mention the better known epizootic diseases, such as Rinderpest, sheep-pox, anthrax and tongue cancer (Rankkorn).**

I might perhaps add some other diseases to these, and on the other hand, perhaps the contagious or miasmatic origin of even those named may be doubted. Despite this, the maximum of completeness is not the most important requirement of a general system, nor is it necessary that the characteristics which have been demonstrated in representatives of the group be present in every species. I am only following the example of the systematiser of natural history, who, when he has constructed his system upon typical well-studied forms, leaves it to time to insert the less well-known or newly discovered species in their proper places. I have excluded the gastric, catarrhal and rheumatic, the so-called remittent fevers from both groups, because they form, perhaps, a transition between both groups. Inasmuch as it seems that remittent fevers develop directly, and even in the same individual, from intermittent ones, they might therefore be added to the pure miasmatic diseases, since even in most cases where they appear in ravaging epidemics, no contagious agent may be demonstrated. On the other hand, however, the gastric and catarrhal fevers are so closely related to contagious forms, the former to yellow fever and even to typhoid, the latter to influenza, that it is difficult to establish their limits. If, therefore, essentially dissimilar disease-processes are not gathered here under the same rubric, the remittent fevers would then furnish just the proof to show that a disease may have a miasmatic origin and in the course of its further development can evolve a contagious agent. The point of view from which this opinion should be judged, can only result from the concept with which we combine the Miasma. For this reason I am leaving the remittent fevers entirely out of the question for the present.

In the third group finally, I wish to place those diseases which arise only through contagions, and which, nowadays at least, are not seen

* Trachoma.

** Mouth or tongue anthrax in pigs (hogs).

to develop miasmatically; such are syphilis, scabies with its manifold varieties and several other chronic skin diseases, probably also glanders and worm diseases among horses, and the malignant hoof and mouth disease of sheep. I must also add hydrophobia to these, since it arises independently only among the canine species, but through contagion among all other animals. Even when it appears spontaneously among dogs, it is very likely not produced by a miasma, since it always occurs only in individuals at any season and apparently becomes epidemic only through contagion. It is doubtful whether the black pox may find a place among the contagious diseases. It is the result of poisoning by means of the humors of an animal which died of anthrax, thus of an entirely different disease. As long as it has not been proven that the black pox itself reproduces the contagious agent, the latter belongs then in the group of animal poisons such as are present in corpses for instance, after peritonitis. Mandt,[4] by inoculating animals with the poison from man, obtained only superficial suppuration.

Since I have set myself the task of seeking explanations concerning the nature of the miasmas by investigating similarly acting contagions, actually only the second group of the three mentioned, that of the miasmatic-contagious diseases can be used. The pure contagious diseases will, however, likewise serve to elucidate the nature and laws of contagions. On the other hand, by this means one can learn nothing concerning the miasma of the simple miasmatic fevers, and it remains purely hypothetical.

Even in the miasmatic-contagious diseases the miasma has been found per exclusionem, i. e. it is presumed, where no contagious agent may be demonstrated, and therefore its properties are only negative. The investigation of the cause of the miasmatic-contagious diseases must therefore start by investigating the contagious agent; first its properties will be presented briefly, then from these we shall draw a conclusion as to the nature of the contagious agent and lastly, an explanation of the miasmatic-contagious diseases based upon this theory will be attempted.

[4] Darstellung der wichtigsten anstekenden Epidemien und Epizootien. Berl. 1828.

Properties of the Contagious Agent of the Miasmatic-Contagious Diseases

The contagious agent is a substance which in the course of a disease is excreted by the sick organism—I do not say produced in the diseased body, as one usually expresses it—and which communicated to healthy individuals, produces the same disease in them.

The contagions are divided into the transient and the fixed. The latter are communicated by direct contact, the former through the atmosphere. The fixed contagions may be transmitted or inoculated by means of matter which has been taken from the sick organism, the transient ones cannot be transmitted. Only those of the third disease group or of the simple contagious diseases are fixed contagions. The contagions of the miasmatic-contagious diseases are all transient.[5] Some of them are also known to be fixed, that is they are not only spread through the atmosphere, but can also adhere to fluids and solids, such as the contagions of smallpox, plague,

[5] The contagion of vaccinia is an exception, a fact which is probably not due to its original properties, but is rather conditioned by several accidental conditions. 1. The quantity of contagious matter in every organism is so small, that it cannot act easily by means of the atmosphere. 2. Vaccinia is a propagated and modified matter, and it is very probable, that in its primary form, perhaps as malanders or genuine cowpox, it is also transient. Entirely similar conditions are found in sheep-pox. These too have a transient contagious agent which, according to Waldinger and Liebbold, may be transformed into a fixed one, producing only a single pustule at the place of vaccination by repeated inoculations. (s. Veith Veterinärkunde, 3 Aufl. Bd. 11. S. 505). Indeed others have seen generalized smallpox arise from the fifth, twelfth and thirty-first propagation of sheep-pox inoculating matter, and which also infected through the air. In man, after inoculation with vaccinia, rare cases exhibit a generalised eruption, the so-called cowpox rash and it should be investigated as to whether here also a transient contagion is formed. 3. Finally, one should consider, that vaccinia, cowpox and sheep-pox yield an effective inoculating material only then when the pock is still watery and transparent or lymphatic and that vaccinations with pus from the pocks will either have no success, or will produce malignant ulcers, which do not protect against contagious diseases. The contagious agent, for an unknown reason, becomes inactive after suppuration has begun. Now the contagion may be emptied from the surface of those internal mucous membranes with a soft superficial membrane, when in the lymphatic condition, and in this way the transient part may be communicated to the atmosphere. By means of the raised epidermis on the external skin the lymph is hermetically sealed and well kept, until the contagion has become inactive through suppuration. Infection is possible only by opening the pock artificially before suppuration begins. Whether the material removed contains a transient contagious agent, has likewise not yet been investigated.

dysentery, coryza, hospital gangrene, contagious ophthalmias, and perhaps several others.

The fluid and solid palpable material, by means of which the otherwise transient contagious agent appears fixed and, as it were, bound is the vehicle of the contagion. The fluids of the sick organism —pus, mucus, blood, excrements, lochia, etc.—are vehicles. That each of these materials is not infectious in its totality, but is rather only the vehicle, proceeds from the fact that the contagion even outside these fluids is spread by aeriform means, or more precisely phrased by being suspended in the air. That which is usually named the fixed contagion of the miasmatic-contagious diseases is therefore a combination of the contagion with fixed materials. Pus from smallpox is pus plus smallpox contagion; plague pus is pus plus plague contagion, etc.

One must differentiate the organic vehicles of contagions from their carriers, which are either inanimate, or are at least organisms not connected with the sick individual and to which the contagion adheres with its organic vehicles or in gaseous form. The best carriers are, as everyone knows, fine porous, animal or vegetable parts: wool, hair, feathers, horns, skins, wood, linen, paper. Smooth bodies, for instance, glass, metal, transmit almost nothing at all. Living individuals may also be bearers of contagious material, due to the fact that it adheres to them externally without affecting them. This explains how armies and herds act as intermediaries in spreading diseases, which were prevalent among them some time ago.[6]

As isolators of contagions one may for instance name oil, oilskin, resin and varnish.

The transient contagion seems to be excreted through the skin and lungs. One can therefore also consider prespiration and lung exhalation as a vehicle of the transient contagion; the contagion appears transient because its vehicle is transient.

When secreted with a fluid vehicle, the contagious matter is fixed in the liquid. This vehicle is usually pus from vesicles, pustules, abscesses, etc. The pathological process, through which the pus containing the contagion, or more generally expressed, the contagious exudate, is formed, does not differ from those by means of which

[6] Lorinser, über die Rinderpest. Berlin 1831. S. 84.

ordinary pus is produced; it is inflammation.[7] Inflammation of the skin in contagious diseases is not therefore the formation of a contagious matter, but rather pus, which however, in these cases contains the contagious agent. The vesicles, pustules, etc., are not the peculiar seed organs or fertilization organs of the contagious diseases, or even of their organs of secretion; as which they have been considered, but rather the usual types of exudation in skin inflammation. This is important because it teaches us to understand how similar contagious diseases may exist, which are alike only in this, but which differ fundamentally in that they neither arise miasmatically nor do they produce contagions.

Everything which has been said concerning the assimilation of the miasma and the contagion into the blood and its critical secretion from the blood by means of or into the exanthema is entirely hypothetical, despite the certainty with which it is repeated daily. Indeed the presence of the contagion in the blood should first be demonstrated empirically. Among the miasmatic diseases, this has occurred only in the case of hydrophobia by inoculation with the blood,[8] and this disease runs its course without any rash. The inoculation experiments, which Namias performed on animals with the blood of cholera patients, and which were supposed to demonstrate the contagious power of the blood, were disproved by Semmola[9] last year. Nor can I consider the experiences with cattle plague as demonstrative. According to Lorinser[10] the blood, mucus, bile, flesh and suet of plague ridden cattle are impregnated with the contagious matter, but this is also maintained with regard to the horns and hooves, indeed concerning every utensil with which the cattle came into contact. When cattle are surrounded by a contagious atmosphere, then blood taken from them can receive the contagion from without quite as well as any other matter. Neither can the presence of the contagion in the blood be proven by the fact that indulgence in the dead animals or in their blood was harmful, since (1) the contagious disease is not produced here and (2) no new contagious matter is formed. The blood behaves in these cases rather like an animal poison, and

[7] Cf. my paper on the formation of mucus and pus.
[8] Hertwig. Beiträge zur näheren Kenntnis der Wutkrankheit, p. 156.
[9] Omodei Annali. Genn. p. 150.
[10] Ueber die Rinderpest, p. 129.

thus the fluids of the corpses may resemble in their effects the most varied, even non-contagious, diseases. Those cases, where small-pox and measles have been transmitted from the mother to the fetus, seem indeed to establish the possibility of a reception of the contagious agent into the blood. In the same way one may demonstrate that the infection of the blood is not necessary, since the cases, where the fetus has been spared while the mother suffered with small-pox, are perhaps even more numerous;[11] what is even more decisive, is that the vaccination of a pregnant woman did not prevent the child which she had born from contracting small-pox three years later.[12] If one considers in addition to this, that small-pox has been observed in the fetus, where the mother did not suffer from this disease,[13] indeed even where the mother had previously already gone through and recovered from it,[14] then the entire argument loses its value. However, admitting that the presence of the pox contagion in the blood were proven by the cases mentioned, it still does not follow that the rash is a critical process, whose purpose it is to excrete the contagious matter. Nothing is more certain than that in glanders of horses the blood may become infected but this occurs only secondarily; the exanthema or the local inflamation is primary, and in favorable cases, the only thing that happens.

It is easier to prove theoretically that an inflamation of the intestinal or respiratory mucosa arising from mechanical causes or a chill, must resemble a miasmatic inflammation of the same organ, than to specify the means by which one may determine practically the diagnosis of such conditions. There are thus sporadic forms of croup, dysentery, cholera, puerperal fever, etc., which can hardly be distinguished from the epidemic, i. e. miasmatic forms.

No fixed contagion (with the exception of the simple contagious

[11] Among 32 cases of small-pox in pregnant women which Kite collected (Essays and observations physiol. and med. Lond. 1795, p. 213), the fetus was infected in only 15 cases. Heim (Die Pockenseuchen im Königr. Würtemb. Stuttgart. 1838) says p. 370: "all the newly born children of mothers suffering from small-pox were born with clean skins; those born alive were nevertheless forthwith attacked by the disease." The same is true of Variolois, p. 396.

[12] Davidson, Lond. med. Journal, vol. X, p. iv, p. 353.

[13] Gazette salutaire, 1780, Nr. 30 Kite, a. a. O. S. 220.

[14] Mead, opera, Vol. 1, p. 252; Jenner, Abhandl. d. med. chirurg. Gesellsch. in Lond., Berl., 1811, Nr. XX.

diseases) can act, when it is brought into contact with the unbroken skin. Its action is conditioned by its reception, either under the skin [15] by inoculation, or on mucus membranes or ulcerated surfaces. The transient contagions also appear to act at first only on mucous membranes or ulcerated surfaces, since the inflammatory symptoms always arise at first in the mucosa and later spread to the skin. The symptoms of the disease do not appear directly after the entry of the contagious agent but rather after a certain period, which varies in the different contagions. It takes 2-3 days in small-pox, 3-5 days in the plague, 7-8 days in sheep-pox, 4-6 days in rinderpest, etc. This period is the stadium latentis contagii. One may consider the contagious matter as remaining at rest at the point of inoculation during this period. The excretion of the contagious matter is also due to certain temporal relationships of the miasmatic-contagious diseases. Most of them produce it at the period of their acme, others, like scarlet fever, only towards the end during the period of desquamation.

In this manner one can therefore follow historically, as it were, the further development of the contagion in the diseased organism. The noxious matter enters at one spot (in inoculation the spot is very localized). Apparently it rests for a time, and then expresses its effect on the organism by means of fever and an inflammation of the skin, which either takes place only at the spot where the cause of the disease entered cow-pox, (catarrh, colds), or spreads even further. The pus or the vaporous secretion of the inflamed membranes again contain the cause of the disease, indeed, the quantity is augmented, and it (i. e. the certainty of infection) is in direct proportion to the spread of the skin inflamation; therefore disseminated and localized pocks, for instance, are less infectious than confluent ones.

It is easy to prove that contagions and miasmas actually multiply within the diseased organisms. An atom of pox poison can produce a rash over the entire body. The pus from each of these pustules,

[15] One usually says, in the blood. This is however a surreptitious, circumlocutory expression. One only knows that the inoculating material does not act on the uninjured epidermis, it does not prove that it necessarily enters the circulation; one could just as logically conclude, that it enters into the nerves.

is again capable of infecting a new organism, etc.; whether this can proceed indefinitely is still doubtful. The contagious matter, however, does not multiply only in the entire body during the course of the contagious disease, but also locally. Repeated inoculations from a vaccine pustule are ultimately without success. After resting, an effective inoculating material may again be obtained from it.[16] They apparently also multiply outside the body. According to Howard [17] an atom of plague poison communicates itself to an entire bale of cotton.

Just as there are various miasmatic-contagious diseases which are well defined according to appearance and course, so one must establish specific differences among the disease causes, the contagions. Usually only one species of disease is epidemic at one time or in the same place—one disease seems to exclude others—and thus, single individuals also rarely have more than one miasmatic disease at a time. Nevertheless exceptions occur, for example, whooping cough and measles or scarlet fever, small-pox and scarlet fever, vaccinia and measles, etc. Both diseases then progress in the attacked organism either simultaneously, undisturbed alongside each other (in such cases they have sometimes been seen spatially separated, small-pox on the one side, measles on the other), or the latent period of the one disease is so prolonged that the other disease meantime runs its course.

From all which has been mentioned till now it follows that the contagion of the miasmatic-contagious diseases is a matter which may float in the air as well as be contained in the fluids of the diseased body; a material which remains in the sick organism for a definite time, and is capable of multiplying within it.

It still remains for us to become acquainted with the physico-chemical properties.

There is nothing to be said concerning the external form and shape of the contagion, since even the microscopic examination of contagious fluids refer, as I shall show later, not to the contagion itself, but rather to its vehicle. Otherwise, the fluids which are impregnated with the contagious matter cannot be differentiated, as one knows,

[16] Stark, allg. Pathologie, Bd. 1, p. 371.
[17] Account of the principal Lazarettos in Europe, p. 61.

from corresponding benign fluids. The aeriform contagion is entirely removed from sight.

It has been asserted, concerning the transient contagions, that they possess a peculiar odor: the plague contagion that of sweet apples, small-pox that of musk, scarlet fever that of cheese, measles that of freshly plucked goose feathers, etc. It cannot, however, be decided as to what share the contagion has in this odor. I do not know, whether Schnurrers' observation (allg. Krankheitslehre S. 54), that the typhoid contagion sometimes gives rise to a special sensation of smell only in those who are infected, is correct.

The diffusion and action of the contagions are increased by heat; they are destroyed by a high degree of heat, cold, concentrated acids and alkalis, chorine and arsenic vapors, smoke, and acetic acid. The digestive principle also destroys infectious matter; we know concerning many, that they do not act when they are brought into the stomach and digested.

According to Hertwigs' experiences [18] a febrile, vesicular rash broke out after indulgence in the milk of cows suffering from hoof and mouth disease. The infection in this case could spread out from the mucosa of the oesophagus, and first communicate itself to the stomach from there. Once the stomach has been attacked in this manner, then the secretion of the gastric juice ceases.[19]

The great tenacity of most contagions is striking; plague, small-pox and vaccinia contagions keep for years, the poison of small-pox and hospital gangrene even in putrefying bodies.

Even dessication does not cause the fixed contagions to lose their action, as we know from countless experiences with the vaccinia contagion.

Nature of the Contagion of the Miasmatic-Contagious Diseases

From the physico-chemical properties of the contagions, it appears probable that their matter is organic, the more so, since chemical

[18] med. Vereinsztg., 1834, Nr. 48.

[19] Perhaps one may consider the infectious power of the milk in this case as a proof of the passage of the contagion into the blood. I wish therefore to remark further, that the rash may pass from the udder into the milk ducts, indeed it may even arise primarily in the latter.

analysis has not found any binary mixed materials, either in the fixed contagions, or in the air of sick rooms, which could be blamed.

Brugmans, Moscati, Jahn [20] shook the air of rooms in which patients suffering from hospital gangrene, fever, small-pox and scarlet fever were to be found, with water, and attempted to prove, by means of the reaction of the water with the salts of gold, silver, lead, and tannin, that it had taken up an organic material. This of course does not prove the organic matter to be the contagious agent, since the air in other sick rooms would probably behave in just the same manner. It does demonstrate, however, that organic matter may be suspended in the air.

I will now adduce the reasons which prove that the matter of the contagions is not only organic, but also animate, indeed endowed with individual life, and that it stands in the relation of a parasitic organism to the diseased body. This view agrees in principle with the old theory of the contagium animatum which has often been opposed, and which, again and again, has presented itself anew in an improved form, since the manifestations in the course of the contagious diseases must at all times, in fact, have led to it. In contrast I wish to protest against an apparent agreement, which the theory of the living contagion might show when considered superficially, with a theory which as a residue of the "Naturphilosophie" in Germany still has numerous adherents, among them men of great scientific influence. Not the contagion, but the disease is considered as a parasitic organism by this school, or even more ambiguously as a parasitic life process. The contagious agent is the germ or seed of this parasitic being with the borrowed body, by means of which it reproduces itself. The fact that miasmatic diseases become contagious is the essential, cardinal point and support of this theory, and according to an unintelligibly applied analogy it is explained as follows, that the disease in its fullest development may become procreative, just as any organism is first capable of generation at the height of its vigor. In order to oppose the basis of this theory, even from a theoretical point of view, it would be necessary for me to deviate too far from my subject. I do not wish to conceal the fact though, that I have always considered it, despite the consistency

[20] Physiatric, S. 316.

with which it has been carried out in all particulars, a clever comparison, carried out indeed sometimes only out of interest in the joke, rather than an actual explanation. Here I am only concerned to show the difference which exists between the contagion in our sense of the term and the animate disease seeds or germs in the sense of the afore-mentioned school. The difference permits of characterization in a few words as follows: according to our theory, it is not the disease, but rather the cause of the disease which reproduces itself. To choose a rough example, think of a thorn which has stuck in a finger and produces an inflammation and suppuration. Should the thorn be discharged with the pus, then the finger of another individual may be pricked with it, and the disease may be produced a second time. In this case it would not be the disease, not even its product, that would be transmitted by the thorn, but rather the stimulus which engendered it. Now supposing that the thorn is capable of multiplying in the sick body, or that every smallest part may again become a thorn, then one would be able to excite the same disease, inflammation and suppuration, in other individuals by transmitting any of its smallest parts. The disease is not the parasite, but the thorn. Diseases resemble one another, because their causes resemble each other. The contagion in our sense is therefore not the germ or seed of the disease, but rather the cause of the disease. For example, the egg of a taenia is not the product of the worm disease even though the worm disease may have been the cause. which first gave rise to a taenia in the intestinal contents—nor of the individual afflicted with the worm disease, but rather of the parasitic body, which, no matter how it may have come into the world at first, now reproduces itself by means of eggs, and produces the symptoms of the worm disease, at least in part. It is not the seed of the disease which is inoculated, but the cause of the disease; the latter multiplies in the sick organism, and is again excreted at the end of the disease. We shall now not inquire any further, whether this actually occurs as a germ, or an egg, or a sprout, or as anything else; it does not occur as a sperm, because then it would still be in need of an egg to fertilise, and least of all as a seed which together with the organism to be infected produces the disease.

The reasons which prove the individual life of the contagions are as follows:

1. The ability to multiply by assimilating foreign materials is known to us only in living organic beings. No dead chemical substance, not even an organic one, multiplies at the expense of any other; when brought together, they always enter into combinations from which the original quantities of the materials acting upon each other may again be separated.

Fermentation is considered proof of the contrary, and it is assumed that during fermentation the ferment reproduces itself, since the smallest quantity of the latter suffices to maintain fermentation in the largest quantities of the fermentable fluids, as long as there is sugar to be converted into alcohol and carbonic acid can escape. For this reason the riddle of the multiplication of the contagia was believed to be solved, when the latter was compared with a ferment, which is regularly generated anew from the blood. This comparison seems to be very apt, but it is just this which especially supports the view presented here. Fermentation is as Cagniard Latour [21] and Schwann [22] have shown almost beyond any doubt, the decomposition of an organic fluid by vegetable bodies, lower fungi, which grow and multiply at the expense of fluids containing nitrogen and sugar and in doing so they decompose the sugar, etc. The granules resembling pumpkin seeds, which Leeuwenhoek [23] discovered in vinegar, wine and beer, are not crystals, as Leeuwenhoek believed—for which reason he named them Sal aceti—but rather parts of a thread fungus (Torula cerevsiae Turpin). Leeuwenhoek had already remarked that he had often seen the salt pieces combined to branched figures, and he depicted such. Schwann describes them most precisely in beer yeast and as follows (op. cit. p. 189): "partly round, for the greater part, however, oval granules, which occur singly, but are, for the most part, connected in rows of 2-8. Usually one or more other rows stand obliquely upon such a row. Often one sees a small granule situated at the side, between two

[21] L'institut, 1837. Décbre. Compt. rend. 1838. 23 Juill.

[22] Vorläufige Mitteilung, betreffend Versuche über die Weingärung und Fäulnis in Pogg. Ann. 1837, Bd. XLI, S. 187.

[23] Opera omnia, L. Bat., 1822, T. IV, p. 2 ff.

granules of a row, as the basis of a new row, and usually a small body, sometimes drawn out lengthwise, is to be found on the last granule of a row."

Cagniard Latour followed the development of the little spheres, which he immediately recognized as vegetable organisms, hourly during the brewing. At first they were simple, then one or two buds which later expanded to the size of the first sphere appeared on each, and these in turn developed buds, etc. He saw further that the yeast granules, while acting on the mash, contracted and developed seeds, from buds arose later when they had reached the size of the mother granules. Thus, as in other lower fungi, there is a two-fold reproduction, by means of seeds and by budding.

Freshly pressed grape juice does not contain such granules. After 36 hours at a temperature of 20 degrees one already finds, however, according to Schwann's observations, some fungi in it, consisting of a few granules. They grow perceptibly under the microscope, so that one may already observe the increase in the volume of a smaller granule, situated upon a larger one, after ½-1 hour. Schwann found that they differ somewhat from the granules of beer yeast. Most of the wine yeast granules are rounder and do not lie so regularly in straight rows. The description of the yeast-plants in diabetic urine given by Quevenne is very similar.[24]

2. The action of the contagia was also compared with fermentation in that the quantity of the effect is in no relation to the quantity of ferment used. A needle dipped into diluted chicken-pox material (a grain of chicken-pox material having been mixed with a half dram of water) is still capable of infecting.[25] This action by a minimum depends on the ability of the agent to multiply, as has been demonstrated in fermentation and putrefaction, and is therefore a further proof of the animate nature of the contagia.

3. The precise, typical course of the miasmatic-contagious diseases, and the relations in the course of the corresponding epidemics themselves seem to speak for an independent, temporal development of the disease-cause, which occurs only among organic beings.

Fever has at all times been regarded as an essentially typical disease, and for this reason the regular course of the miasmatic-

[24] L'expérience, 1838, Nr. 26. [25] Jahn, Physiatrik, S. 363.

contagious diseases has been ascribed to the pathological process of the fever. In one of the following papers I will show that fever is not necessarily typical, that on the contrary its course depends on the cause which produces it. An acute inflammation runs a typical course and insofar, one could seek the reason for the regular course of the miasmatic-contagious disease in the participation of the skin inflammation. The disease does not, however, always consist of a simple inflammation. Several eruptions often follow one another in the given period. Besides it seems that the course of the inflammation nevertheless varies more according to its vehemence and the individual disposition, than miasmatic diseases usually do. Finally such a period never elapses between the infliction of a wound or chemical irritation and inflammation as between inoculation and outbreak of the rash. From all this one may conclude: that the disease cause has the most important share in the orderly course of the miasmatic-contagious diseases, and that it has an orderly, temporal development, a property which is a characteristic only of the living.[26]

Perhaps the duration of a single disease may be treated as equal to the duration of life of a generation, the duration of an epidemic, on the other hand, as equal to the life period of a species, since as we notice, in organic substances certain species of infusoria appear, exist for some time, and then disappear again to make room for new vegetable or animal structures. In an infusion we see monads, vibrios, finally rotifers appearing and existing so long, until the fluid is not fit any more for the nutrition of these beings, one could say, until it is completely infected. After a time molds arise in it, and the substance which was not capable of harboring animal organisms any more, shows itself still suitable for vegetable ones. Couldn't one express this as follows: that one species of these beings has destroyed the disposition for the reproduction or the

[26] Abildgaard reports a very remarkable fact which is entirely inexplicable without the independent development of the contagious agent. (über die Rinderpest Viborgs' Sammlung 1, S. 67). When poison for the rinderpest inoculation is taken from an animal which is recovering, then it often happens that at first mild attacks arise which subside completely. On the 21 and 22 day after the inoculation the inoculated animal begins to leave its feed untouched and usually becomes violently sick. The normal stadium latentis contagii of rinderpest is 8-9 days.

nutrition of the same species? At least there is a striking analogy with many epidemic diseases, which spare the body in which they had once appeared, for the duration of the epidemic and often during its entire life.

Finally, I do not wish to leave any experience unmentioned which even if its does not exactly prove the opinion defended here, at least permits of its being explained by means of this point of view. It is the experience that all miasmatic-contagious diseases attack particularly the healthiest and most robust ones, and develop with the greatest intensity in them. If contagia are parasites that multiply at the cost of and to the detriment of the sick organism, then the more nutriment the latter can offer them, in other words, the better the soil is in which they luxuriate, the more exuberantly they will probably thrive. For the same reason almost every other disease is a preservative against the ruling epidemic disease.

How are the Symptoms and Course of the Miasmatic-Contagious Diseases Explained by the assumption of a Contagium Animatum.

Due to the difficulty of direct investigation, the greater part of our knowledge concerning the nature of the contagious agent is inferred from the observation of contagious diseases. For this reason the most important test with respect to the value or worthlessness of the assumption of a living contagion is whether and how the phenomena during the course of miasmatic-contagious diseases permit of explanation by means of it; to submit the theory to the test, so to speak, I will outline it briefly.

However, although I am refraining from an investigation of the position which the parasitic beings, constituting the contagious matter, occupy in the succession of organic organisms, for an understanding of the following, it should be remarked, for the present, that they belong at any rate to the smallest, lowest, but also to the most fruitful organisms known.

As far as the simply, local forms are concerned, the explanation of the phenomena follows easily. Through the action of the parasites on the living matter either inflammation or putrid decomposition arises. The course and type of the contagious skin inflamma-

tion will be discussed under the acute exanthemata. An example of putrefaction caused by a locally acting contagion is furnished by hospital gangrene. It is an old dogma that the vital force opposes putrefaction, and that no putrefaction takes place in the living body. This is only partially true. Mold formation, which is closely related to putrefaction, has often been found in living insects, and even in birds.[27] Valentin [28] saw a conferva vegetating on the intestinal mucosa of a crayfish. The number of analogous cases can, however, be multiplied infinitely, if putrefaction is recognized as that which it is not a simple decomposition of organic matter into its elements, but rather its transformation of organic substance by fungi. Putrefaction and the formation of infusoria keep pace with one another. According to Schwann [29] those materials which are demonstrably strong poisons for infusoria and molds also prevent putrefaction. Others such as Extr. nucis vomicae spirit are only poisonous for infusoria, but not for plants. It prevents putrefaction with the development of hydrogen sulphide, but not the formation of molds. Organic substances can neither ferment, nor putrefy, nor become moldy, even in atmospheric air, if they are boiled, and the air which is conducted to them is heated thoroughly.[30] Putrefaction is consequently the decomposition of dead, organic matter by organic beings which feed at its expense, and if it must be admitted that foreign organisms can feed on the substance of the living body and assimilate it, then the possibility of putrefaction in the living body will also have to be admitted. As a rule the individual force of an organic part manifests a stronger attraction for the nutritive components of the body than a foreign organism; the army of entozoa prove sufficiently that the latter can, under certain circumstances, also gain the upper hand. It may be said: while in ordinary putrefaction the infusoria decompose organic matter which is already dead, it is simultaneously killed and de-

[27] Heusinger, Entstehung niederer vegetabilischer Organismen in Bericht von der Zootom. Anstalt in Würzburg. 1825.

[28] Repertorium für Anatomie und Physiologie. 1937, S. 110.

[29] Op. cit., p. 184.

[30] A similar experiment, with reference to the formation of infusoria and molds, and with the same result was previously reported by F. Schultze in Pogg. Ann., 1836, Bd. XXXIX, S. 487; the decomposition of the fluid was not considered.

composed by contagious parasites. For this reason destruction accompanied by phenomena of putrefaction also takes place more easily in declining health; however, hospital gangrene attacks even the healthiest body. Moreover one should not forget that the phenomena of hospital gangrene are still very different from those in the putrefaction of dead matter, and have perhaps just as much similarity with mold formation. I leave undecided, whether the reaction of living matter or the nature of the contagion—the parasite which decomposes—is to blame for this. The so-called general reaction symptoms in contagious inflammation and in hospital gangrene do not behave differently than in other local diseases.

I will deal at first with the acute, miasmatic-contagious diseases with inflammation of the skin, and particularly with the so-called contagious exanthemata, external and internal.

The disease begins with the entrance of the parasitic organisms or their germs. The entrance occurs only in mucous membranes, as far as they are accessible from without, or in injured places of the external skin, and indeed, often in sharply defined regions, according to the species of the parasites; just as the actual epizoa and entozoa prefer definite regions of the body—I just wish to call to mind the various species of the lice. It is worthy of notice that miasmatic-contagious diseases of the mucous membranes are often seen without an inflammation of the external skin, but that all external exanthemata are complicated by exanthemata of the mucous membranes. The latter almost always appear to be primary, if an area of the skin has not been made the original seat of the rash by direct inoculation, in which case the mucosal exanthemata may also be lacking. The first spots to suffer in almost all epidemic diseases are the conjunctiva, the nasal entrance,[21] the pharynx, the oral cavity, the esophagus and stomach; the disease remains restricted to the nasal and pulmonary cavities most often—in catarrhs and colds—just as in dysentery it is in the terminal portion of the digestive canal that the symptoms appear first.

[21] Shouldn't the sneezing, with which, according to the older reports, the earlier, malignant epidemics of influenza announced themselves (Schnurrers Chronik der Seuchen, l. 151, ll. 76) be considered a proof for the entrance of the injurious matter by this route. In China small-pox was inoculated by blowing the scabs that had been rubbed into a powder into a nostril.

At first, during the stadium latentis contagii, the parasites do not give rise to any perceptible symptoms; either they remain undeveloped during this period, or some time is necessary until they have multiplied in such quantity as to make themselves felt in the body in which they live.

After that there appears, as already indicated, inflammation or putrefaction; the latter, as in hospital gangrene and also in angina gangrenosa and other forms, is due on the one hand to the nature of the contagious agent, on the other to the diminished vitality of the diseased individual. One may ask whether the quantity of the contagious matter is to be blamed for the difference in the result—a smaller quantity producing inflammation, a greater quantity, putrefaction. I believe this question may be answered in the negative. One must indeed differentiate putrefaction resulting from contagion, from gangrene. Gangrene can just as well be the result of contagious inflammation as of others, and to be sure the more intense the inflammation, and furthermore, the greater the quantity of the inflammatory irritant is, the sooner this will occur.

The first symptoms are often, aside from the local reactions, movements and sensations conditioned by reflex action from the spinal cord; I have already mentioned sneezing as a reflex movement caused by irritation of the nasal mucosa. This is also joined with yawning and other spasms of the respiratory muscles, small twitchings similar to shivers, tonic convulsions in the extremities, particularly in the lower ones (the cramps in the calf which have become so well known through cholera) and many others. It seems that this last symptom occurs sooner, when lower parts of the digestive system suffer, as in dysentery and cholera, which is consistent with the laws of sympathy, to be developed later.

The inflammation which the contagion provokes, is more or less superficial, and accordingly the exudate appears either evenly, and therefore as simple desquamation, or in the form of single papules, vesicles, or pustules. These various results of inflammation also occur on mucous membranes, in accordance with the form of the disease and according to the character of the epithelium. Later, even when the disease has passed through all its stages, the results

of the skin inflammation purulent and confluent pocks, intestinal ulcers and the like may remain, and become the causes of sequelae.

The skin inflammation spreads further from the spot where the first infection occurred. This can happen in three ways:

1. The parasites themselves, luxuriating as it were, spread progressively through the body, either over the external skin or beneath it. In the latter manner the external skin may become the seat of the exanthema from the mucosa, and does become so in most diseases, while they descend probably into the lungs, but rarely beyond the stomach into the gut. Perhaps the spread of the parasites occurs preferably toward the external skin because there the exchange of atmospheric oxygen, the need of all life, is easier. It is not unimportant to remark in this description, that all acute exanthemata which begin in the oral and nasal cavities, in the nose or the eyes, progress from the head down the trunk and often do not extend further than the upper half of the body, whereas in dysentery the contagion of which appears to act principally from the lower part of the intestine, the skin rash, if it breaks out at all, first attacks the abdomen.[82] It would also be understandable, why an influence, which suppresses the development of the disease toward the external skin, would have such grave consequences, because its rank growth towards the internal cavities, in particular the lungs, would be favored.

It would be decisive for this view, if after inoculation the extension of the exanthema would spread each time from the point of inoculation chosen at random. Investigations concerning this are not present. However, I find it noted that cowpox extends from the milkers' hands to their forearms;[83] that malanders of horses, inoculated into cows' udders, produced vesicles at the point of inoculation and around it, which showed the course of regular cowpox.[84] We know further concerning sheep-pox, that upon inoculating it in its original form an eruption over the entire body follows. Pessina suggested a means of attenuating the intensity of the contagion, as follows: that ten sheep be inoculated from a sheep with

[82] Zimmermann, von der Ruhr usw., Zürich, 1767. S. 14.
[83] Hering, über Kupocken an Kühen, Stuttgart, 1839. S. 101.
[84] Viborg, Sammlung von Abhandlungen usw., Bd. V, S. 275.

natural pocks, that ten others again be inoculated from that one of the first group which has the best pocks, etc. By this continued involution, as a homeopath would call it, the pox should become continually milder and produce fewer vesicles, until the eruption finally confines itself to the single point of inoculation.[35]

This claim is opposed by more recent practitioners. The protective power and the milder course of the vaccinated sheep-pox has been put beyond a doubt, namely by Kausch and Müller,[36] and Krüger,[37] who at the same time also showed that the cultivated pox doesn't at all lose its intensity as continually, as the Austrian authors claim, and that general eruptions are rather frequent, irregularly intermittent, and appear again in later generations. Indeed there are some things among the observations of the doctors mentioned which support the theory that the spread starts from the place of infection. Müller prefers to inoculate the tail; Krüger the ear. The former speaks of the appearance of accessory pustules or of a general exanthema on the inner surface of the thigh (op. cit. p. 27); the latter saw the accessory pustules on the inner auricle, on the head near the ears and on the neck. In numerous cases no vesicles appear at the point of inoculation, but rather further down on the neck under the wool. "The snowy weather which came on the day after the vaccination and caused the blood and lymph vessels of the ear to contract, can alone be considered," the author continues, "as the cause of deviation from the rule. Having had this phenomenon called to my attention, I now found this phenomenon often, not only in single sheep, but also in larger groups, which had been vaccinated on cold days. Despite this I consider the vesicle which diverges from the point of inoculation, just as protective and safeguarding, as those which appear only at this point." Others also corroborate this,[38] that the accessory pustules contain the contagious agent just as well as the vaccination pustule. This is important because the accessory vesicles would otherwise be considered

[35] Kopps Jahrbuch usw. Jahrg. VIII, S. 343, med. Jahrb. des oesterr. Staats. Bd. 11, St. 3, S. 29, St. 4, S. 25.

[36] Der Wert der kultivierten Schutzpockenimpfung, Leipzig und Züllichau, 1817.

[37] Ueber die Schutzkraft des kultivierten Impfstoffs der Schafpocke usw. Prenzlau, 1825.

[38] Tessier, über die Schafzucht usw. Aus d. Fr. von Mitte, Berlin, 1811, S. 135.

only as the products of a sympathetic spread of the inflammation and not as the products of a contagion.

2. The extension of the skin inflammation may be traced to a sympathetic excitation of such areas of the skin which the parasites themselves have not yet reached, just as in scabies many skin regions, to which the mites do not ascend, gradually become the seat of the exanthema. General desquamation even when the disease was limited locally, is proof of such sympathy, as for instance the desquamation of the skin in scarlet fever, or after an exanthema of the internal membranes, because desquamation always points to a preceding exudation. The accidental participation of the glands—the parotid, more often yet the liver in gastric exanthema, by which the gastric fever becomes bilious, as one expresses it, the tonsils in the exanthemata of the pharynx—in epidemic eruptions could be explained by the progress of the inflammation from the principal areas of the skin. The urinary organs also become affected in the same way and shed their epidermis at the height of the disease or towards its end (scarlet fever, cholera). Finally, just as gonorrhea may lead to orchitis by progressing along the continuity of the mucosa, so catarrhs of the biliary ducts, of the urinary passages and of the salivary glands can change to hepatitis, nephritis and parotitis. The explanation of the extension of the exanthema by sympathy is not suitable for those cases where it is demonstrated that every inflamed portion of the skin contains contagious matter, as in small-pox and here only the first explanation or perhaps the following one are right.

3. The skin inflammation can spread by means of the blood. The admittance of the cause of the disease, that is of the parasites, into the blood and its deposition in other parts of the skin which is usually considered as the most usual cause for the extension of the exanthema, takes place perhaps only in rare cases. There is no cause, as we have already remarked previously, to consider an absorption of the contagious matter into the blood necessary and important. However, its possibility in single cases cannot be denied. If the inflamed areas of the serous membranes which Petzhold [89]

[89] Die Pockenkrankheit mit besonderer Rücksicht auf pathologische Anatomie, Leipzig, 1836. S. 29 ff.

described are actually pocks and contain contagious matter, then it could have arrived there only by way of the circulation, by means of the blood. The absorption of pus into the blood can become more important than the absorption of the contagious matter—I designate the process with the usual expression, without wishing to admit thereby, that the pus is absorbed in its entirety and by uninjured blood or lymph vessels. The results of such an absorption of pus are however the same in the miasmatic diseases as in other inflammations—erythema, abscesses, rapid inflammation in the sphere of the greater circulation in exanthema of the lungs and vice versa, congestion and inflammation of the lungs in eruptions of the external skin and the other mucous membranes. Inflammations of the serous membranes and particularly of the synovial membranes can also arise in exanthematic suppurations of contagious diseases just as in other extensive suppurations of wounds, burns, etc. The anthrax boil and the gangrenous erysipelas of the skin (St. Anthony's fire) in many older, more malignant epidemics can with good cause be considered as the result of a putrid inflammation of the lungs and the admission of the noxious matter into the greater circulation.

There is however, still another species of local incidents, resembling inflammations, which the miasmatic-contagious diseases have in common with all those, in which the blood suffers dissolution and a significant decomposition so that it diffuses out of the capillaries here and there. Sometimes, there is an extravasation of its substance and then hemorrhages, petechiae and suggilations result; sometimes there is only a transudation of diluted serum, stained more or less red by the dissolved blood pigment through the vascular walls, which is followed by the so-called passive and hypostatic inflammations, so-called and incorrectly so to be sure, only because of a remote resemblance to inflammatory exudation. These incidents manifest themselves in scurvy, and in every acute disease with a significant change in the blood (extensive burns, pneumonia and hepatitis etc.) which ends in the so-called Status putridus and therefore also in miasmatic-contagious diseases it is all the more certain the more the contagious agent in its development simultaneously changes the blood—we will consider this immediately.

The so-called " back-blood " and the white carbuncles in the anthrax of cattle are apparently due to this cause, since there is no spot in the corpse of an animal which died of anthrax, which does not show evidence of the changed character of the blood.

Magendie [40] recently called attention to the manner in which the ecchymoses and hypostatic inflammations arise, and demonstrated that one may produce similar phenomena artifically, by injecting animals with carbonic alkalis which prevent the coagulation of blood or by withdrawing the blood fibrin—by beating and reinjecting the blood drawn from the blood vessels. He concludes from this that the decreased blood viscosity is the cause of the afore-mentioned incidents, since the circulation is impeded because of it. Even if this explanation should be right, Magendie extends it incorrectly to the true inflammations. Every local inflammation is the result of a decreased blood coagulability, and he considers the miasmata and contagia which wherever they may be produce a local inflammation, as materials which dissolve the blood fibrin. I have attempted to disprove this view in the yearly report of Müllers Archiv 1839, no. 3, to which I refer the reader.

The fever and the so-called general symptoms may be traced to a dual origin.

1. The fever is the result of a local inflammation, such as accompanies other non-miasmatic inflammations in a similar manner. I have devoted a special section to the further investigation of this relationship.

2. The change in the blood or in the organic substance, at whose expense the assumed parasites multiply, can be the cause of the fever. The blood must be altered by them, just as a putrefying or fermenting substance experiences chemical changes and indeed in extreme miasmatic-contagious diseases it exhibits the same physical and chemical properties as in putrefaction (status putridus). Nevertheless less weight should be placed upon this fact, than might appear at first sight, since non-epidemic diseases can also end in putrid fever.

This second point is the more important cause of the fever in the miasmatic-contagious diseases, because usually the fever is more

[40] Leçons sur les phénomènes physiques de la vie, T. 11, IV (in many places).

intense than it would be in pure skin inflammations of the same extent and intensity. It appears further, that without the general action on the blood, the disease would not exist in its fullest development and for that reason would not protect against falling ill anew through the same contagion, as would otherwise be the case. Since the protective power does not depend only on the extension of the exanthema but also on the regularity of the fever, then the fever should be recognized as the sign of a specific change of the blood or of the humors in general, which impedes or makes possible a new development of the complete disease in the same organism. But even so the fever is still the result of local changes and of the local development of the cause of the disease and not something independent or original.

That fever also occurs without an exanthema (for instance febris scarlatinosa sine scarlatina) is no proof of the former's independence since in these cases only the external exanthema is lacking and the inflammation has perhaps only extended all the more to the lungs. In vaccinated sheep-pox the intensity of the fever is in direct proportion to the extension of the rash and in general, leaving a particular constitutional irritability out of the question, one can say that in the natural exanthemata the fever is also proportional to the extension of the eruption—internal and external taken together. To imagine the fever as the process by which the contagion is made or excreted is not only unphysiologic, but is also directly disproved by the facts, since there are exanthemata, namely vaccinations, whose course is almost feverless, and which still protect and produce contagious matter. Local infection and formation of contagious matter in the pustules can still take place later in individuals who have already gotten over small-pox. Reil reports two cases pertaining to this (Fieberlehre Bd. 5. S. 296). Davidson (op. cit.) tells of a boy, in whom a small-pox vaccination had taken affect, but ran its course without fever. He transmitted the vaccination successfully further. Several weeks later the same boy was infected naturally.

The disease ends favorably and in order, when the parasites cease living or growing perhaps after they have formed the contagious germs. Then the pustules and vesicles open and discharge the pus

which is impregnated with the contagion, or they dry up and drop off as crusts, which enclose the contagion. In this manner and by dry desquamation of the skin, as after scarlet fever and measles, the contagious matter must disseminate itself as dust in the atmosphere surrounding the patient and become air-borne. If the exanthema is situated in the mucosa of the respiratory passages, then the sputa and the exhalations of the lungs contain the germs of the contagion. If the intestine and particularly its lower part is occupied by it, then the excrements are impregnated with the inflammatory products and also with the germs of the parasitic organisms.

Now if the parasite has passed through its development until its death or until germs are formed or at least as far as it is possible in the attacked organism, then the disease is finished, the skin inflammation is not renewed again and passes in the well known manner into recovery. I am not speaking of crises here. First the eruption itself, then the exuded matter, and then the skin which is desquamated at the end of the disease (sputa cocta) were considered as a critical evacuation, because their appearance certainly indicated the approach of recovery and with the disappearance of the disease the fever vanishes.

The inflammation, the fever, in general all the incidents which are the result of the action of the contagion, can reach such heights, that the organic reaction as it is called, does not end with the cessation of the cause. The disease then ceases to be typical. The suppuration of contagious matter can become ulcerative under certain local or general influences just as well as any suppurative wound. The fever can exhaust the forces so much, that the removal of the cause is not sufficient any more to restore health. There follows a long nervous period, febris nervosa lenta, slow convalescence and the like, about which I do not have to go into detail here, since it is not a phenomenon which is characteristic of any of the epidemic diseases.

On the other hand it appears indispensable to show how an explanation of the metastases of skin eruption is possible without the assumption that a matter pre-existent in the blood, the contagion to be eliminated, casts itself upon this or that organ, when it cannot develop and be excreted in the organ of its choice.

The fact, that it is the result of a cessation of the original disease, belongs to the conception of a metastatic disease, even if one demands only the minimum. I will show first, that very often, where one believes to see a metastasis of an exanthematic disease, no such condition takes place, but rather that the disappearance, the deletion of the exanthema, is the result of another disease, which has developed dependently or independently of the former.

1. The exanthematic disease produces a fever in the afore-mentioned manner and as a result a degree of general weakness, which prevents the progress of the local disease process. Blisters and other inflammatory stimuli do not act in this way on an organism whose nervous forces have been exhausted.

2. The exanthema, by progressing along the continuity of the mucous membranes, by infection of the blood with pus or in some other way, results in a sympathetic internal disease, in the inflammation of a more delicate organ and the like, and the cessation of the exanthema is again the result of the internal disease.

3. The exanthema is complicated by an internal disease (scarlet fever by hydrocephalus); the latter causes general asthenia and a recession of the external disease.

In all these cases the metastasis is only apparent. Even when it is proven, however, that the internal disease first arose metastatically and as a result of the suppression of the external one, then it is adequately explained as follows, that when the exanthema or rather the parasite, who is its cause, meets with obstacles in its outward development, it will spread all the more in the opposite direction, inward. This tallies not only with those cases where the full-blown or developing external exanthema disappears, but also there where it has not even appeared, that is where the internal disease strictly speaking is not metastatic, but rather vicarious.

Perhaps that is why those exanthematic diseases, such as smallpox and sheep-pox, which are inoculated into the skin, are much less pernicious if they extend over the surface of the skin and are accompanied by intense fever, because the exanthema progresses less towards the internal membranes. Even rinderpest occasionally passes without any significant fever after the inoculation, while the

vaccination wound swells and suppurates.[41] Measles, inoculated directly into the skin, are supposed to excite eruption, tearing and sneezing but less coughing and inflammation of the eyes than the accidentally acquired infection. Home [42] who instituted these inoculation experiments repeatedly, ascribes the mild course to the fact that the infection did not occur through the lungs.

Finally if metastases are still left, which cannot be understood with these assumptions, where the internal disease is the result of the disappearance of the external one but is not caused by it in continuity, even this does not prove a development of the contagion in unusual places. One need only call to mind the scabies metastases, which no one will trace anymore to the wandering of scabies matter, however imperative such an explanation may have seemed but a short while ago. Should we not wish to say any more about this point than we know, then nothing further follows with certainty from such experiences, except that, if a prevailing activity or excitation of a part suddenly ceases, a disturbance of equilibrium ensues, which can become detrimental to the other parts. The manner in which it happens becomes clear, only when the causes of the sympathetic connection of the parts among themselves are understood.

The miasmatic-contagious disease progresses according to the norm, if the diseased body presents it with all the means for its development and if the body's forces are not exhausted by it. In the opposite case either the aforementioned sequelae occur or the epidemic disease is abortive. The fulminant forms, which appear particularly at the beginning of epidemics with symptoms of apoplexy, suffocation or rapid gangrene, belong to the abortive ones; these appearances, which may be explained by the rapid suppression of the pulmonary function, but also in several other ways, are therefore of no value for any hypothesis. It is not difficult to imagine, how an animate matter which is suspended in the air and inspired with it would be able to give rise to these incidents, if it develops energetically in the air passages.

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[41] Abilgaard, über die allgemeine Rindviehseuche in Viborgs Sammlung, Bd. 1, S. 67.

[42] Principia Medicinae Ed. 4, p. 196.—Med. facts and experiments, London, 1759, p. 285.

I have sought to demonstrate that the peculiarities of the so-called contagious diseases may be explained through a local extension of the contagious agent, and that it is not imperative to assume a passage of the latter into the blood. That such is possible, should, as we said, not be denied. Indeed, there are facts concerning the appearance of even the external exanthema, which might be explained more easily by an extension of the contagion by means of the blood, than by its direct progress along the continuity of the membranes. Thus one often sees only single, isolated pustules on the forehead and hands in small-pox, if it arises internally through the agency of a transient contagion. Should one assume, that the parasitic formation is indeed present here between the extreme points where the pustules are situated but so slightly developed that it does not give rise to an inflammation, or that it has only passed through the space between the pustules without developing? Isn't it easier to imagine that the contagion is communicated to the pulmonary veins in the lungs and by means of them to the systemic arteries, where it then settles down here and there within the domain of the capillary system of the greater circulation? With reference to this we have the analogy of the so-called pus metastases from the lungs.[48] In contrast to this, it again remains inexplicable, using this interpretation, why small-pox does not appear more frequently on the lower extremities; why, even when there are very few pocks, they still erupt in the identical sequence from the head down to the trunk; why the serous membranes, particularly the joints in which every other kind of mechanical disturbance of the circulation, as far as it arises from the blood, first produces pathological changes, are not attacked more. Only one thing can help us with these doubts: direct observation. Whether the contagious matter is spread in the diseased body by the blood, should issue from the results of inoculations with small-pox blood. Until then it is permitted to add small-pox to the miasmatic contagious diseases, among which the contagion propagates itself on the surface.

The plague seems to behave quite differently. Since the change in the lymph glands is the first and essential symptom, according to

[48] Cf. Günther in Rusts Magazin 1834, Heft 2; Magendie, leçons sur les phénomènes physiques etc., T. III.

the observations of Bulard already mentioned, then the disease must start by absorbing a noxious matter, the contagious agent, from the external skin and the mucous membranes by means of the lymph vessels. The disease cannot propagate itself in the vessels or even along the continuity of the tissues since the lymphatic branches between the glands are not attacked, but rather a matter must be introduced, which being transmitted only along the lymphatics, first develops its action in the glands. All other changes, the swelling of the veins, hemorrhages, petechiae, softening of various tissues and also of the intestinal membranes are not constant and can be considered as the results of blood changes arising from the lymph glands. If the interpretation is correct, then the plague contagion would differ from the contagion of the disease heretofore considered, in that it does not develop on the skin as the latter does, but rather in the lymph vessels and lymph glands, a parasite of the lymph, so to speak.

The Organisation of the Contagion

After having shown that the contagion is a matter endowed with individual life which reproduces itself in the manner of animals and plants, which can multiply by assimilating organic material and can exist parasitically on the sick body, the question then arises as to how the body of this heretofore unseen parasite, whose vital expressions make themselves known so distinctly and destructively, is constituted. It lies within the laws of human phantasy, if one once considers the contagion as something living, that one must ascribe one of the forms to it which the known organic world presents to our senses. For this reason one guessed at the insects in the earlier, childlike period of natural science—some simple souls still do so today—and as the microscopic animals were discovered, the infusoria could with still greater cause be accused of being contagion and miasma. Now since we are daily becoming more acquainted with the wide distribution, the rapid multiplication and the vital tenacity of the lower, microscopic plant world, it is even more natural to imagine the contagion as having a vegetable body. This conjecture received a powerful support through the observations which Bassi and Audouin made recently on a contagious or miasmatic-

contagious disease of the silk worm, the muscardine.[44] I wish to communicate them coherently here and as completely as the importance of the subject demands.

The silk worm, which is attacked by this disease, hardly ever reveals it by external symptoms. Only rarely does it turn red shortly before its death or show disseminated, red or yellow spots here and there on the surface of the body; only towards the end of its life does it stop feeding. The characteristic signs of the disease first appear after death, in that the body covers itself with a white powdery efflorescence, dries up and becomes mummified. We know already through Foscarini, Configliachi, Brugnatelli and Bonafous that the efflorescence is a mold, through whose touch or inoculation the disease is communicated. However, it was first pointed out by Bassi that the efflorescence is not an accidentally formed vegetation on the dead body of the silkworm and not just the product of the disease, but rather also its cause.

The germs of the fungus, introduced into the body of the silkworm, grow at its expense inwardly first of all; after the death of the silkworm they first bore through the skin and a forest of fungi appears, which luxuriates all the more rankly, the warmer, moister and quieter the surrounding atmosphere. By and by the small cryptogams lose their water, dry up and change to a powder, which contains the germs and which at the slightest movement rises from the body on which it was produced and scatters in the air. The germs are so fine and so numerous on a single individual, that they can spread everywhere with the greatest rapidity and attach themselves to everything even to the smoothest bodies, and remain suspended long in the air. If the external vegetation is missing, it does not mean that the contagion is absent; it is only unable to spread spontaneously, but by opening the dead animal and touching or inoculating others with its contents, it will be transplanted further. In the

[44] Bassi, del mal del segno, calcinaccio o moscardino, sec. ed. Milano, 1837. Audouin, recherches anatomiques et physiologiques sur la maladie contagieuse, qui attaque les vers à soie etc., Ann. des sc. nat. T. VIII, p. 229. Nouvelles expériences sur la nature de la maladie etc., ebendas, p. 257.—Cf. further Balsamo in biblioteca italiana, T. LXXIX, p. 125. Lomeni, l'innocuita e l'efficacia de' lescivi medicinali di potassa etc., per la cura del mal del segno.—Montagne, histoire botanique de la muscardine, Abstr. in Ann. de sc. nat., T. IX, p. 5.

silkworms of Phalaena dispar, even with the naked eye, Bassi saw the white efflorescence in the inside of the body which appeared hard and brown outwardly.

The infectious power remains longer in the white spots of the body where the germs are more numerous and more mature than in the dark ones, and when these and the internal parts of the silk worm have become ineffectual, then one still succeeds in transmitting the disease by means of the white vegetations on the surface, which is definite proof that the fungi are the actual contagious agents. The germs maintain their contagious action for a long time, up to three years. The eggs of a colony which has been attacked by the epidemic can produce the disease in another healthy colony by means of the germs adhering to its surface. In how many thousands of ways such a light, fine and vitally tenacious matter may be dragged from one place to another can hardly be reckoned. Bassi (op. cit. p. 32) mentioned the most usual means of communication. I must refer to his work for further information since it would lead us too far from the subject to report all the interesting data. The disease occurs most intensely in the spring (May, June) and its extension is favored most of all by warm and dry weather. If the weather becomes damp and unfavorable for the development of the fungi, then they kill the silkworm which they invaded, but they do not appear on its surface, they do not produce any fruit and because of this the disease is then not contagious any more. (Part 1. p. 40.) Bassi remarked that good nutrition, complete health and vitality expose the silkworm more to infection than the opposite properties and that in a colony the sick worms always apparently appear to be the best (p. 37). The means which Bassi proposed for disinfection and whose effectiveness he tested are the usual ones, nitric acid fumes, sulphuric acid, chloride of lime, boiling water, liq. kali. caust. These are also supposed to serve as therapeutic remedies; Bonafous and Lomeni on the other hand consider the chemical means as insufficient to cure the disease, since when used weakly they only favor the development of the fungi and in a stronger dosage they kill the parasite together with the silkworm. Mercury preparations alone prevent completely the development of the molds, but they too are not without danger for the silkworms. In order to destroy the

fungi which may cling to the eggs, Bassi advises washing them in diluted alcohol (17°-20° Reaum.) whereby the eggs themselves do not suffer.

Bérard (Ann. d. sc. nat. T. IX. p. 17) considers a solution of copper sulphate to be the most effective means of disinfection. The result as far as therapy goes appears to be that the contagion must be prevented and that the cure of the disease must be abandoned.

Bassi considered the muscardine a simple contagious disease. Audouin proved however through his experiments that it may also be produced artifically, independently and without inoculation (miasmatically). Larvae of Saperda Carcharias which he kept in moist glasses filled with moss, died of this disease and were covered with the same whitish fungi as the silkworms, soon after death. Silkworms, inoculated with these fungi, took sick and died in the same manner. Transplanted from these the fungi produced the same disease. Bassi had maintained that only the spores of the fungi are capable of transmitting the disease to other animals. Audouin, on the contrary, proved that a transmission is possible by inoculating the filamentous processes (Thalli).

One must agree with Dutrochet, when he says that the facts which according to Bassi's presentation still permitted many objections and actually experienced them, were first proven by Audouin, who combined anatomic and microscopic investigation with the experiments concerning contagiousness.

Bothrytis bassiana, as Balsamo named the fungus, also develops on inorganic bodies, according to Montagne's observations. The fruit formation always begins on the 4th day no matter what the soil may be. Sporidia form in the inside of the threads. An isolated spore is sufficient to produce new and germ-producing fungi.

The tissue in which the kryptogamic plants develop preferably in the silkworm, is the pigment layer under the skin and the fat body. From the point of inoculation it spreads out by means of root-like processes, and also in that single small spheres, which float freely in the fluid, become loosened and can be communicated to the blood.

If one reads this short presentation attentively, in which I have introduced the author's own words, then one will be reminded in

every line of analogies with the miasmatic-contagious diseases of the higher animals and almost every principle founded on experience which has resulted from observations on the latter, seems to find its explanation in the quoted facts. Under favorable conditions (here in stagnant moss) the cause of the disease arises independently as a miasma, becomes epidemic and contagious under the influence of heat and drought, and spreads further again only by means of contagion. Towards the recession of the epidemic its contagiosity is decreased and lost. Air currents carry the contagious agent over wide stretches, so that the disease may occur in another place with the appearance of a miasmatic one. The contagious agent is thus aeriform and fixed at the same time; it may be inoculated. It is destroyed by the usual means of disinfection. In the dry condition it retains its power for years. An immeasurable and imponderable quantity of it, a single spore, suffices to develop the disease to the most ravaging epidemic. The strongest and best nourished silkworms are most predisposed and form the most contagious matter. The subcutaneous tissue is the seat of the pathological changes. Finally the fruitlessness of the chemical remedies.[45] These are only the most important incidental points and should one wish to follow up the comparison in more detail, then more of them will be found.

I only wish to remark yet, that perhaps future investigations may consider the fact that Bassi always found an acid reaction in the silkworms that died of muscardine, which does not occur during life or after death resulting from other diseases. A needle dipped in it rusts. Bassi considers the acid to be phosphoric acid and ascribes it to the phosphates formed, that the corps remains white and dries up without decaying.

There is a contagious agent then, which is in fact of a vegetable nature and indeed exhibits the greatest correspondence with the known species of fungi, so that Montagna desists from assigning the Bothrytis of Muscardine to a separate species. We survey the entire field of the epidemic diseases of man and the higher animals

[45] Mercury, which extirpates the contagious agent in muscardine radically, unfortunately together with the infected individual, is also one of the most important remedies in human contagious diseases.

in vain, however, for such an observation, which proves the similarity of a contagious matter with known animal or plant bodies. The older observations, for instance, those of Sacco, Kreisig, which circulate in the manuals, and even those of Jahn [46] are entirely valueless. They speak of microscopic spheres which are supposed to be found and to move about in small-pox lymph, plague matter and in eruptions, without being differentiated from pus spheres, and without indicating any precautionary measures by means of which to safeguard against putrefaction of the investigated fluid and against formation of infusoria in it. Gluge [47] describes (1) a number of smaller more translucent spheres of the same size and (2) a coherent, viscous, so-called interstitial mass consisting of fine granules, in the pus of small-pox, besides the pus spheres and others which one recognizes as epithelial membranes. Neither of them, however, are elements peculiar to small-pox pus; they are to be found in the most variable kinds of pus, although, to be sure, not usually in actually good and developed pus. Nothing could be more desired than an observation like that of Böhm, by which the presence of microscopic fungi in the intestinal contents of cholera patients [48] was determined, if this fact did not allow itself to be traced to other causes. Böhm himself recognized the identity of these fungi with the yeast plants of beer which his patients drank in large quantities. However, I cannot agree with him that this plant species, characteristic of wine fermentation, thrives and luxuriates preferably in the intestinal canal of cholera victims. I have found it in large quantities in vomited substances and in the gastric and intestinal contents of many corpses, if fermented beverages had been enjoyed. Whether they proceed to grow in the body I would neither wish to affirm nor deny; in no case, however, do I believe that they have any relation to the cholera.

Finally to these observations I have to add my negative experiences which I was able to make, occasionally, to be sure, on typhoid cadavers, on small-pox and vaccinia contagia, on desquamated skin of scarlatina and other skin diseases. I can surely affirm, that neither

[46] Physiatik, S. 359.

[47] Anatomisch-mikroskopische Untersuchungen zur allgemeinen und speziellen Pathologie, Heft 1, Minden, 1838, S. 70.

[48] Die kranke Darmschleimhaut in der asiatischen Cholera, Berlin, 1838, S. 57.

any of the known infusoria nor a plant of the yeast type nor Bothrytis bassiana are to be found in the contagia mentioned.

If under the present condition of our technical means the question concerning the nature of the contagious agent could be solved with certainty, then a demonstration on theoretical grounds, as I have attempted it, would be superfluous and a very unnecessary, roundabout way. Unfortunately, however, it may be predicted that a strict proof by positive observations is as yet impossible, even if they should speak more in favor of our hypothesis than the former ones. Even if living, mobile animals or distinct plants are found in contagious materials, then they may have arisen accidentally just as in benign pus, or in all animal secretion when they have been exposed to the air for some time. And even if they would be found constantly in contagious matter and inside the body, then the objection would still be possible and at first hardly to be refuted, that they were only parasitic, even if constant elements of the contagia, just as indeed one still hears maintained concerning the spermatozoa, that they are elements which may develop in the fluid and may even be significant for the diagnosis without therefore being the active stuff of the fluid or of the semen. It could be empirically proven that they are actually the active part, if one could isolate the spermatozoa and the spermatic fluid, the contagious organisms and the contagious fluid and observe the powers of each separately— an experiment which one must probably abandon.

On the other hand, however, the negative result of our observations is not sufficiently certain in order to give up an hypothesis which appears necessary through the general conceptions which we connect with life. It is not even necessary to have recourse to the excuse that the organisms of the contagion are too small for our optical instruments. However, if they are not mobile animal beings, but rather their eggs or the germs of lower plants, then I know of no means to differentiate these from the cells, their nuclei or their granular contents as they occur in the epidermis, in pus, indeed in all tissues and excretions, if the type of their association or their further development throws no light on it. The small spheres of which the Bothrytis bassiana on the surface of the dead silk worms consists, behave entirely like pigment granules and the

smallest microscopic molecules with molecular movement, which one comes across in every purulent fluid. I have observed and examined chemically the granules of which the lower plants consist, mixed with pus together with the degenerated nuclei of the pus bodies, without finding a difference which might have served as a reliable basis for the further investigations. Indeed, the errors made by Balsamo [49] and Turpin [50] prove how easily one can confuse even the largest spores with the animal fat granules and vacuoles; of these the former represented the thalli of Bothrytis bassiana as developing directly out of the granules of the silk worms' fat-body, the latter represented the molds which arise on milk (Penicillium glaucum) as developing from the milk globules themselves.

In certain respects these things are in fact identical. It had long been admitted that even if not the eggs, at least their essential parts, the germinal vesicles of all possible animals, resemble one another completely as far as we recognize them, so that even the material difference which manifests itself so distinctly in the progress of development, was defined as a simple dynamic one. Later single observers were again struck by the resemblance of certain animal elementary structure in the membranes, the glands, the nerves, the bones, etc., to the germinal vesicles and by the resemblance of all these parts to plant cells. The work of Schleiden and Schwann [51] provide the key to these puzzling facts. They show that the primary origins of the most diversified organic formation are the same everywhere; granules or droplets around which a disc or cell forms, which becomes the nucleus of a second, enclosing cell. The most complex animal or vegetable body is an aggregate of such cells developed in various directions, and on the other hand there are lower plants and probably also animals, i. e. mobile creatures, which consist of only one simple cell or of a few cells joined together. This explains why the interpretation of the microscopic granules as such is so difficult. However, this great discovery brings on new difficulties at the same time, since through it the concept of in-

[49] Bassi, op. cit., p. 64.

[50] Annales des sciences naturelles, T. VIII, p. 338 ff.

[51] The latter have now appeared completely under the title: Mikroskopische Untersuchungen über die Übereinstimmung in der Struktur und dem Wachsthum der Tiere und Pflanzen, Berlin, 1839.

dividuality becomes a relative one. Inasmuch as an independent maintenance of form and composition under different external influences, an orderly, temporal development and reproduction are properties which are shared not only by the entire animal or plant organism, but also, in a limited measure, by its isolated elementary structures, it becomes difficult to separate the latter rigorously from the lowest animals or plants. The cylindrical cells of the ciliated epithelium of some animals still vibrate for weeks after their separation from the organism to which they belong. The spermatozoa retain their vital expressions even longer, and the egg itself is essentially a cell which has been separated from the maternal body and which under favorable conditions develops independently to a complete animal; and if among isolated cells, taking no account of the egg, one has not observed any growth or formation of young cells, as for instance in the body among the cells of cartilage or of the decidual membrane, then it seems to proceed from the fact that conditions for nutrition are lacking in the separated elementary parts. Where these are present, as for example, after transplantation into a strange but congenerous organism, it grows indeed and even multiplies perhaps, just as a parasite can leave the body in which it was born and live further in another of the same species. The possibility of transplantation rests upon this relative independence of the elementary parts, and the longer a part, after separation, is capable of maintaining its life—in a latent condition—the fitter it must be for transplantation. One could therefore also explain the contagious agent and the infection as follows, that under certain conditions the elementary parts change pathologically, and that the changed elementary parts may possess the faculty of growing further in other organisms and at their expense. Apparently a transmission of this type from one part of the body to another part of the same body takes place in neoplasms which have been called parasitic, because the independence of their pathologic tissues attracted attention. Cancer, melanosis, oftenest however medullary neoplasms spread from the parts first attacked along the veins and lymph vessels, if these, no matter in what way, have received elements of the pathological tissues, and the germs of the pathological formation can be brought even to the remotest spots by means of the blood

stream. It is known that pus particles are received by the veins like small foreign bodies and can circulate with the blood until the narrowness of the vessels in the capillary circulation checks their further progress. Pus particles from the pulmonary veins excite stagnation and inflammation in the range of the greater circulation; pus particles from the systemic veins cause the same in the pulmonary capillary system. If tubercle cells [52] instead of the pus particles go over into the blood, there would not be a simple inflammation and suppuration produced where they are deposited, but rather tubercles would again be produced, since the tissue of the tubercles cannot be denied the power to grow at the expense of the neighboring parts. Perhaps it is in this manner and not by a generalisation of the dyscrasia that one may explain why in extreme degrees of phthisis tubercles usually develop in the intestine, in the serous membranes and the bones. One could call this type of extension an infection or contamination of one part of the body by another.

If cancer, warts, condylomata, tubercles and the like are actually infectious, which I cannot decide,[53] then the infection would be a transplantation, so to speak, of a pathological tissue which continues to grow after its transplantation to new soil. The entire course of development of the disease may be presented briefly as follows: As a result of a certain bodily constitution and of external noxious influence acting over a long period an unsound condition of the blood develops, or, to express myself less definitely, a dyscrasia. Many local diseases, chronic inflammations, eruptions, neoplasms,

[52] The tubercles also consist, as I have shown in another place, of elementary cells which are filled with a characteristic granular substance. These cells form around their nuclei, reasoning by analogy, and within an exuded formless substance, the cytoblasteme. A question into which I do not wish to go further because at present all means towards its answer are still lacking, is whether the varied significance and further development of the cells depends on differences of the cytoblasteme or on the influence of cells, already formed and living, upon the entirely homogeneous cytoblasteme. In the first case the cell nucleus, and even the formless fluid matter in which the cells are first supposed to be formed, as well as the exuded fibrous material, would suffice in order to transplant them in some way or other to another spot or to another body as the metastasis of an elementary tissue.

[53] Malin relates a remarkable example of the contagiosity of phthisis (Caspers Wochenschr., 1839, Nr. 14). Two dogs, which used to lap up tubercle pus, died hectically. I remember a similar case, where a cat which was always in the same room with a phthistical woman, was attacked by a cough and died of cough.

etc., can result from it. Should a local parasitic neoplasm arise because of the general dyscrasia, then it grows and spreads within the attacked body, and is again the cause of definite general symptoms (for instance, an inflammatory or hectic fever) depending on its location, its stage of development, and the state of degeneration. It is this neoplasm again, which through transplantation of its elementary parts, can take root and luxuriate in another body, and then bring on the same consecutive symptoms in this body, which is caused in the one in which it first arose. As consistent as this explanation appears, it is perhaps just as superfluous, since, as has been said, the contagiousness of the parasitic tumors, even of the condylomata,[64] may still be doubted, and is still actually doubted by many. For this reason this entire presentation may be considered, for the present, as a comparison for the purpose of elucidating a second hypothesis explaining contagion. The first conjecture was that the contagious matter of the miasmatic-contagious diseases contains lower plants or animals or their germ. Now the second possibility is added, that it consists of pathologically formed and isolated animal elementary parts—elementary parts of the individual from whom the infection emanates—which have achieved a certain independence. This last case is improbable among the miasmatic-contagious diseases of men and the higher animals because we do not know of any of their elementary parts which maintain their vital energies for such a long period after being separated from the body or which again produce them fully after dessication. In order to decide this question, the investigation of how the contagia, generally speaking, first develop, is however more important. If the contagious agent first arises within the diseased body in the course of a disease which was evoked by any other causes at all, then one should not consider it as being of an independent animal or plant nature, unless one has any more reasons for the possibility of an unequivocal generation than may be adduced in the present state of the controversy. However if it could be demonstrated that a contagious agent can be formed outside of the body, as has been proved in the quoted observations of Audouin on the muscardine, then such

[64] Ricord has often attempted to inoculate the pus of cancers and condylomata, but always without success.

a contagious agent could only be an animal or plant sort, even if one unknown at present. The question concerning the origin of the contagia is however closely connected with the investigation of the miasma to which I therefore now proceed.

The Miasma of the Miasmatic-Contagious Diseases

Only the miasma of the miasmatic-contagious diseases shall be dealt with here, as I mention repeatedly, since the conclusions which have been drawn from the investigation of the corresponding contagia, only permit of application to them.

While some of the diseases which I have assembled in the miasmatic-contagious group, spread more often by direct infection, according to our experience, and the others more miasmatically—by means of a general noxious matter contained in the atmosphere—there is hardly one for which both types of extension could not be admitted as coexisting side by side. Diseases whose contagiosity is undoubted because, being bound to fixed materials, they can be inoculated, can still be considered miasmatically conditioned if they suddenly appear at one place in large numbers, if they break out simultaneously in various places after having long been unheard of, and finally if one can demonstrate such external atmospheric influences, which generally occasion the origin of epidemics. On the other hand one is forced to admit the possibility of a contagious communication, even in those diseases whose miasmatic origin seems undoubted, if persons living near one another and under the same influences, are attacked by the disease one after the other, and if the disease is brought to a place which was healthy until then by an individual from an infected neighborhood, and in this place it evidently proceeds from the dwelling of the sick man.[55]

Epidemics spread in dual fashion then, miasmatically and contagiously. If one now sees how the same disease is produced by a miasma here, and by a contagious matter there, shouldn't one feel

[55] In no disease have the proofs for and against the miasmatic and contagious origin been investigated with such thoroughness and objectivity as by Mathaei in yellow fever (See his prize work—Über das gelbe Fieber Bd. 1, Hannover, 1827). The result is that the disease is contagious, but that the contagious agent can also develop independently.

moved to conceive both miasma and contagious matter as identical materials? The academicians take great care to keep both concepts distinctly separate. "The miasma," they say "is a noxious matter, originating externally and mixed with the air, which enters into the body, and produces disease even in infinite quantity, in the manner of poisons. The contagious agent on the other hand is a material which is formed by a disease and which occasions the same disease in others." Contrary to this it must be remarked that in practice one is often unable to decide whether a disease producing potency which is mixed with the atmosphere, has been formed within the diseased body or outside of it, whether it is a miasma or a transient contagion. The older authors designated even the latter as miasma, and again differentiated the miasma as contagium mortuum from the usual so-called contagion (C. vivum). Let us consider now, how the genesis of the infective matter can be decided in a concrete case. If the diseased individual can prove that he came in contact with another individual suffering from the same disease, then he is infected. If the contagious atmosphere of a diseased individual is wafted towards another individual across the street, or a few houses further away, then the latter receives the diseases through a miasma. It can therefore be only a difference in degree, which causes one to consider the same disease, sometimes as contagious and sometimes as miasmatic. The matter which a single patient excretes, is so small that it only transmits the disease in its immediate neighborhood. If many patients are crowded together in a small space, then the contagious matter produced by them acts over a larger area, and again becomes a miasma. During epizootics one has even had the opportunity to measure the diameter of the infectious atmosphere which surrounds the sick individual. It only amounts to a few feet in the contagious lung disease of horses, in cattle plague it is 4-6 yards according to Abildgard. If the animals are so placed that the distance between them is more than 12′, then usually no infection takes place. Is an animal therefore, to which the contagious matter has been brought from afar, since as we know, such is possible through air currents, is such an animal miasmatically diseased?

Admitting, however, that many cases of disease which are called miasmatic, are actually caused by contagion, then the miasmatic

origin under the above mentioned circumstances is indeed very probable, and the question still remains to be answered, how far the identity of the miasma with the contagion may be proven. A matter which is mixed with the air, is introduced into the body. The result is a disease with characteristic symptoms. In the course of the disease or at its end a matter is excreted by the sick body, again transmitted to the air, and this contaminated air produces the same disease with the same symptoms in a second individual. With the same right with which one considers the contagious agent of scarlet fever in one case as identical with the contagious agent of scarlet fever in a second case because the disease symptoms in both cases are the same; with the same right the miasma which the first case of scarlet fever called forth, is also to be regarded as identical with the contagious agent, as a result of which the second scarlet fever appeared. However in reasoning of this kind a mistake is possible: Since most of the symptoms of disease are secondary, through the instrumentality of the nervous system, and since it is in the nature of the nervous system to react in the same manner to the most varied stimuli, then to infer similar causes from similar effects as necessary as it otherwise is, is not entirely dependable. Meanwhile one may indeed consider the identity of the miasmata with the corresponding contagia as probable, until proof in another certain way will be possible.

What we do know concerning their physical and chemical properties does not contradict this assumption, although it suffices just as little to prove it.

If the contagious matter and the miasma are however identical materials, then that which was discovered concerning the contagious matter applies just as well to the miasma. The miasma of the first miasmatic-contagious disease, which is again excreted at the close of the disease, and which thus proves itself to be a matter capable of reproduction and development within a definite period out of internal causes, is alive. The contagious matter is so to speak a miasma of the second generation, a miasma which has passed through the first period of development within a sick body. I will therefore combine the miasma and contagious material of the miasmatic-contagious diseases in the following under the title of "infectious matter." It is always the same for any specific disease

and appears to us as a contagion, when its origin from a diseased organism can be demonstrated directly; in the opposite case it appears as a miasma. The fixed contagion is the infectious matter which is bound to a solid or fluid material taken from the diseased body.

One can now consider the genesis of the infective matter in dual fashion, so that it comes either under the hitherto prevailing conception of the contagion or of the miasma.

We wish to subject both views to a more exact examination:

1. Leaving the first appearance of a disease, to which history extends just as little as it does to the origin of the creation of life, out of the question, the infective matter could have a contagious origin wherever the disease seems to arise anew and miasmatically. One knows how long the fixed contagia retain their infectious power, even when dried. If one assumes that the contagious agent of an epidemic remains in such a state of latent animation after the conditions for its extension cease to exist, then the disease could again arise years later under favorable conditions, apparently miasmatically, actually however by contagion. According to this assumption there are no miasmatic-contagious diseases in the sense in which we asserted at the beginning, but there is rather among the contagious diseases only a group with a transient, typically developing, contagious agent. This view has often been heard defended for small-pox, measles and scarlet fever; it is even maintained that these so decidedly contagious diseases never die out entirely, but are always propagated in single individuals and only flare up to epidemics from time to time under certain external influences.

However, in many other epidemic diseases important difficulties oppose this assumption: I have already mentioned that in single miasmatic-contagious diseases sometimes the miasmatic origin, sometimes the contagiosity is more or less doubtful. Some epidemic diseases may be less suited to spread contagiously, because the infectious matter is again excreted from the body in such a manner, which does not easily give rise to infection. Infection must be much easier if, for instance, the dermal transpiration and the pulmonary exhalation of the diseased individual contain the contagious agent than if it is excreted from the surface of the intestine and in the stool. It is also generally assumed that the non-contagious typhoid, if it is not a separate species, differs from the infectious typhoid

in that in the former the exanthema is more restricted to the intestinal canal, while in the contagious form the respiratory passages and also the conjectiva and the skin are attacked in a higher degree, and, for that reason, probably are secretory organs of the contagious matter. Without a doubt there are not only single cases but also single epidemics of miasmatic-contagious diseases in which no contagious matter is formed, or in which contagious cases are at least exceptions (cholera, influenza). Thus with the end of the disease in every individual the cause of the disease is also at an end. If now the infective matter were nothing further than an aeriform contagion, then in every epidemic the number of diseased individuals would have to be in direct proportion to the certainty of infection and an epidemic in which the infective matter does not multiply (by forming a contagion), would very soon be at an end as soon as the infective matter left over from the last disease, if I should express myself exactly, were used up. For there are epidemics of small contagiosity, which are very extensive and rage for a long time. One must therefore (2) at least admit the possibility of a multiplication and reproduction of the infective matter outside of the diseased body,[56] and thus it would necessarily come, according to these and its other properties, under the conception of animal and plant organisation.

I have shown first in the course of this investigation that the infective matter is independently animate, and further that one could think of the independently animate matter as either animal and plant organisms or elementary parts of animals, which have achieved a relative individuality. I then demonstrated how direct observation could neither prove nor decidedly disprove either of these two cases. There was therefore nothing left but to proceed with the theoretical consideration. I concluded further as follows: If the infective matter of the miasmatic-contagious diseases consists of organic elementary parts, then it can multiply only within those

[56] In this manner one could comprehend how infection can proceed from healthy individuals, if they were confined for a long time under conditions, which are favorable to the development of an infective matter. (The famous Black Assizes of Oxford). To maintain that the contagion is formed in the healthy body here, contradicts the conception of the contagion. It is produced around the healthy individual in the space in which he lives, and is spread by him, while he himself perhaps because of unknown causes remains spared.

bodies, to which the elementary parts belong; should it also multiply outside of them or arise entirely independent of them then we must consider them as absolutely individual. How they first arose cannot be ascertained. (In attempting to answer this question we would fare like the friends and opponents of the Generatio aequivoca; that which the former consider as the conditions of formation, the latter consider as conditions for multiplication and development, because one can never with complete certainty exclude all the smallest germs from the experiments which are supposed to prove the Generatio aequivoca.) It became probable however that the infective matter could multiply outside of the body and therefore could be independently animal or vegetable. One can adduce several other arguments to support this result:

1. The origin of epidemic diseases may often be derived from the putrefaction of large quantities of animal or vegetable matter. Miasmatic diseases are epidemic there where decomposition of organic beings constantly takes place, in marshy and moist neighborhoods; they develop epidemically under the same conditions after floods, and furthermore in places where a large number of people are crowded together with a diminished circulation of air, as on ships, in jails and besieged places, etc. One finds examples of it cited in all the old manuals.[57] Since putrefaction and moldiness are however nothing else than the decomposition of organic substance by infusoria or fungi (see above) and therefore if not production at least multiplication of the latter at the expense of the former, then every putrefying body is a hedge of infusoria or a plantation of fungi, as it were, and where organic masses are exposed to putrefaction over wide areas, the entire atmosphere must be filled with their germs. In our times the miasmata are almost generally explained as the effluvia of putrefying or fermenting substances, and it has often been concluded for this reason that they might be infusoria. This hypothesis is very insecurely founded as long as one knows nothing further concerning the miasma, except that it arises from stagnating water, for couldn't such give rise to diseases in very different ways? The matter assumes a new aspect, if one sees that this noxious influence, originally arising from putrefaction, can

[57] Stark has collected them most completely, allgem. Pathologie, Bd. 1, S. 315-319.

multiply and reproduce, that because of internal causes it proceeds through definite periods of development, independently of the soil, in which it luxuriates, and that it is mortal. Only this gives us the right to consider the miasma as being alive, and this may alone be demonstrated in that we recognize the identity of miasma and contagion. For that reason I have left those miasmatic diseases out of the question, in which then the most important criterion, the reproduction of the cause of the disease is lacking. On further comparison of the miasmatic-contagious diseases with the purely miasmatic ague it follows that the latter also lacks the other attributes upon which I placed special emphasis in developing my view of the infective matter. The ague is also not typical, although very precisely rhythmic. It proceeds without exanthema and is, to use the usual nomenclature, most certainly an essential fever. The ague is also never an epidemic or pandemic disease, but rather endemic and, just like scrofula, goitre and cretinism, bound to a definite complex of local influences, while the miasmatic-contagious diseases, for instance, cholera, influenza, plague, pass through entire circles of latitude and longitude in their wanderings, spread under the most varied atmospheric conditions and to the most varied people on the high seas.[58] On the other hand they can be checked in their progress by high mountains and forests. According to old chronicles the plague was stopped more than once at the chain of the Thuringian forests when it advanced from Saxony towards Bavaria by way of Thuringia. Jahn, who cites this,[59] remarks that in the neighborhood of Meiningen similar circumstances occur every year with whooping cough. The miasma remains therefore a purely hypothetical principle as far as the ague is concerned.

It is moreover of no concern for our question, whether the organic matter contained in the air is already actual animals or plants or their germs which develop in a suitable spot and multiply, or whether it is only in general a vital mass determined for individual life, as well as further, whether these beings, having once arisen, propagate themselves through germs, by division, eggs or any other way. Only this is still to be mentioned, that the species of infusoria

[58] Schnurrers Chronik der Seuchen., Bd. 1, S. 15, 11. S. 371.
[59] Physiatrik, S. 378.

and fungi that are formed, are conditioned by the quality of the putrefying substance, in that either the germs contained in the air sometimes seek one soil oftener for their development, sometimes another, or according to another view, in that the general substance to be individualised is determined for specific development by various materials.

If therefore not every putrefaction becomes the cause of diseases, just as the air of sewers, flaying yards, and slaughter houses is often tolerated perfectly well by single individuals who live in it, then one must consider that the types of infusoria and plants which develop, depend on special conditions and that not every type can be equally inimical to health. Thus among all the germs of fungi which the air carries with it and deposits in various places, it is only the single species of Bothrytis, by which the silkworms are attacked.

2. The same means which favor or restrict the formation of the lower organisms or destroy them, also favor, restrict or destroy the action of the infective matter. Everything which was mentioned above concerning the physico-chemical properties of the latter, also fits the former. One knows, to cite an example, how inimical acetic acid is for the life of most of the lower organisms, and so one could already surmise a priori that which has been determined empirically in the case of hospital gangrene,[60] namely, the favorable action of vinegar in preventing and curing the disease.

Heat and moisture favor the production and propagation of the infusoria and the molds, as well as the miasmata and contagia, therefore miasmatic-contagious diseases are most often endemic in warm moist regions and epidemic in the wet summer months. Almost all of them require a certain degree of atmospheric warmth for their development. However one can never predict the origin of epidemic diseases with such certainty, except when a marshy surface has been dried up, as when a strong heat wave follows a widespread flood.[61]

Oxygen is a vital necessity for all organic beings and miasmata are also destroyed in irrespirable air. Only the eggs and sperm of

[60] Leinveber, Ztg. des Vereins für Heilkunde, 1836, Nr. 37.
[61] S. Ferguson, medico-chirurg. transactions, T. VIII, p. 131.

animals and plants retain their germinative faculty even in irrespirable air, and where therefore a contagion retains its efficacy without having access to oxygen, one may assume that it consists of eggs or sperm. This should therefore be assumed everywhere where a contagion, secluded and without multiplying, remains capable of germinating for many years.

There is still another way in which animals and plants maintain themselves for years without nutriment and, as it seems, also without oxygen being taken up, namely by drying, and also in this manner, as has already been mentioned, contagia can be maintained capable of germinating for a long time.

3. If one wishes to present this hypothesis according to the difference between simple miasmatic and contagious cases of disease, then one could express it approximately just as it usually happens, that in the latter it proceeds to the formation of germs within the sick body, in the former it does not. However according to our hypothesis the germ is not the offspring of a disease process, i. e. a series of changes, not even the fruit of a more than mixed marriage between a concept, the disease, and an animal body, but rather the seed of a congenerous organism.

Organisms which do not produce seed or at least not in the body would excite miasmatic diseases; organisms which form germs within the body and which are excreted after the disease has run its course, would be the cause of contagious diseases and the germs the contagious agent. The great tenacity of the contagia in consequence of which they still retain their infectious power after having been withdrawn from all changes of the air would be in agreement with this.

Essentially however it is always the same matter which appears as a miasma, as a transient and as a fixed contagion, one could also say of fermentation, that it sometimes arises miasmatically or by means of a widely spread transient contagion, if the germs of the fungi settle from the air in a fermentable fluid, and sometimes through a fixed contagion, the ferment. The comparison with the muscardine lies still closer; Audouin saw its germs develop independently in moist moss, as miasma and then inoculated them further as a fixed as well as a transient contagion.

How Miasmatic Diseases Become Contagious

Until now I have apprehended the miasmatic-contagious diseases just as the natural scientist does his species, as something constant and unchangeable, at least in the present creation; whose primary origin is just as little accessible to investigation as the origin of the entire animate and inanimate nature. Actually the more characteristic a miasmatic-contagious disease is, the more certain it is that it has prevailed in essentially the same form from those times to which historical research extends, and if it has apparently occured anew anywhere, then it can be plausibly explained that it has either only been transplanted from another place to that one, or that circumstances have favored its extension and increased its virulence to such a degree that it attracts more attention than formerly.

Where the disease appears with such specific characteristics, we also have a right to consider its cause as something constant and unchangeable, as a distinct species; for this reason I may consider the miasma of the diseases named as identical with the contagion, as far as the specific identity of the disease originating miasmatically with that originating contagiously can be determined, and for the same reason I had to explain the so-called ague-miasma as a noxious influence of another kind. It must be added, that other influences besides the marsh miasma, for instance, constant mental sufferings, also appear to give rise to ague (here I must again say: *appear*, since as we do not perceive anything of the ague, with the exception of the reaction of the brain and the spinal cord to unknown somatic changes, then it were easily possible, that these latter were different and the former were indeed similar to one another), while the characteristic miasmatic-contagious diseases, for example, the acute exanthemata certainly do not arise any other way except by means of the infective matter.

It is frequently maintained that a contagious disease could also develop gradually from an epidemic or endemic of ague, and particularly the gastric-nervous fevers, the mucous fevers and yellow fever belong to the diseases which develop slowly out of endemic intermittent fevers under certain conditions and then are supposed to form contagious matter at their peak. In this manner the contagious Egyptian ophthalmia is supposed to arise from a simple

catarrhal inflammation of the eyes and the contagious dysentery and cholera are supposed to issue from a simple diarrhea. This case should probably differentiate from those where the same disease first occurs miasmatically, then contagiously. We may assume here, that because the disease is the same, the noxious cause is also the same, and the only difference lies in the fact that in the beginning it dies without offspring, while later it also propagates itself in the sick body.[62] The assumption of a spontaneous origin of the infective matter appears neither more nor less justified than the belief in a generatio aequivoca in the animal and plant world. There on the other hand, if the ague turns into yellow fever, the first miasmatic disease does not resemble the contagious one, and it appears as if the infective matter were formed within a body whose disease is due to any other causes. It is moreover of no consequence whether this transformation of the intermittent fever into a contagious remittent fever takes place in the course of a disease in the same individual or in the course of an epidemic in different individuals. According to this conception it would always have to be one, who had caught the disease miasmatically and as a more or less simple intermittent fever, and had transmitted it contagiously and as a decidedly remittent fever.

It would be easy to deny the fact entirely, since the possibility, that an infectious remittent fever results from an epidemic of intermittent fever has by no means been placed beyond a doubt, just as on the other hand there is probably no disease, be it ever so

[62] Here I wish to remark again, that I consider every disease as miasmatic-contagious, whose contagiosity is attested even by only one single certain experience. Only an apple-tree can bear apples. And if no apples become ripe in one year, if in a region a fruit bearing apple tree has never been seen, then this changes nothing in the nature of the tree. We still recognize it by its type of growth and by its leaves and blossoms as one which under favorable conditions produces ripe fruit. This must however be the answer to those who immediately consider a disease, for example yellow fever or cholera as purely miasmatic, because in an epidemic no contagious agent was demonstrated or because a sick individual outside of the place where the epidemic prevails, did not transmit the disease further. The parasites too require not only a suitable organic medium for their development and reproduction, but also a definite soil and climate in the wider sense (as the geographic distribution of the Bothriocephalus and the Taenia demonstrates). If yellow fever then keeps to the coast and cannot be carried into the interior of the country, then the only thing to be learned from it is that the infective matter which it produces, finds the conditions for propagation there and not here.

specifically and decidedly contagious, which has not been traced here and there to a prevailing Status gastricus, biliosus, catarrhalis, rheumaticus, etc. In addition to the conditions which generally make the decision as to whether a disease is contagious so difficult, still another difficulty is added, that of diagnosis. As little as every cold is an influenza, as little as every catarrhal inflammation of the eye is an Egyptian ophthalmia, as little as every acute erythema is a scarlet fever—just as little should every remittent fever be considered as yellow fever or typhoid. External and internal exanthemata can arise from many other local and general causes, apart from an infective matter, and fever can be added to these just as to the miasmatic-contagious exanthemata. Concerning this topic I refer the reader to the following paper on fever.

I will nevertheless concede a gradual transformation of the intermittent fever into the contagious typhoid and yellow fever and since it can happen in a very short time I will suggest how this can be brought into harmony with the hitherto presented hypothesis. Two interpretations are possible:

1. One can assume that the infective matter lives or at least maintains itself outside of the animal organism as in the miasmatic-contagious diseases, and that a healthy body is not a suitable medium for its development, but that an antecedent pathological change must have occurred, so that the infective matter could luxuriate in it. An analogy to this hypothesis may also be found in the process of fermentation. Although the matter which causes fermentation is constantly contained in the atmospheric air, fermentation arises spontaneously indeed only in such fluids which besides sugar also contain gluten or any other substance rich in nitrogen. From then on fluids containing sugar but lacking nitrogen can be made to ferment by means of yeast. The ferment is the same in both cases, but the latter case is not suited as regards its chemistry to attract it from the atmosphere or to permit its increase to a noticeable degree. In order to apply this comparison to our subject, then the healthy body would be equivalent to the fluid containing sugar, the infective matter equivalent to the yeast plants and the miasma of the intermittent fever or the morbific matter which has been formed or changed by means of it, is equivalent to nitrogen containing substance. In-

termittent fever arises through swamp air, carburetted hydrogen gas, negative electricity, or whatever else one wishes; by means of the intermittent fever the chemical components of the blood or of the other humors are altered; through this change the individual becomes suited to receive and nourish living bodies which float in the atmosphere, and which then condition a new form of the disease, and wander further as contagious matter at its end. In a similar manner it could happen that diarrheas might arise in many individuals through indulgence in unripe fruit or because of a certain atmospheric constitution, and that just the sick intestinal mucosa would become the medium for the development of living creatures, capable of reproduction, which could again become the cause of intestinal exanthemata.

With this hypothesis it would therefore be possible to manage without generation aequivoca, which we would like to avoid as long as it is possible. Should this nevertheless again receive new support from another quarter, then still another explanation of the development of contagious diseases from simple miasmatic diseases would be admissible, in that one would concede (2) a spontaneous origin of the infective matter. This would then be either partially independent, like the elements of the tubercles, cancers, etc., and in this way too generatio aequivoca could still be avoided, or genuinely alive, animal or plant. Under this assumption the simple miasmatic disease is related to the contagious disease approximately just as one thinks of a dyscrasia, for example, scrofula and helminthiasis; the miasma would be analogous to the causes of the dyscrasia, the contagion analogous to the worms or their eggs. This comparison appears all the more admissible to me, since the formation of entozoa also occurs epidemically, as for example the fluke disease of sheep. The noxious influences which act on entire herds, do not produce liver flukes here, according to the usual conception, but rather a peculiar cachexia, as a result of which the Distoma forms in large quantities in the bile. Once this worm has developed however then nothing is easier, since it does lay eggs, than that they find the way from one individual to another.[63]

[63] The origin of the intestinal worms cannot well be explained today without generatio aequivoca. Nevertheless it is perhaps not unfitting to draw attention

In all of the cases mentioned however, that which one calls miasma is something entirely different from the infective matter. Should one wish to assume for the sake of consistency, that the miasma of intermittent fever is also animate, then it would have to change its character completely so that the intermittent fever could become a typhoid fever, it would have to become an entirely different species, as it were, and the difficulties of explanation would then be the same.

Concerning the Contagion of the Simple Contagious Diseases

I turn finally to the simple contagious diseases in order to investigate how far they support or disprove the view presented con-

here to a fact in the embryology of the intestinal worms, for which more and more evidence accumulates, namely that the entozoa at various life-periods possess very different organisations and appear destined, at a particular period, to live outside of the body, and actually are even found living independently. The Lernäe have eyes and swimming legs in the young just like the actual parasite crabs (v. Nordmann, mikrograph. Beiträge, Bd. 11, S. 49); Monostomata and Distoma are provided with cilia over the entire surface of the body and with eyes in earlier periods (v. Siebold in Wiegmanns Archiv, 1835, Bd. 1, S. 69 and in Burdach's Physiologie, 2 Aufl., Bd. 11, S. 1833; further Dujardin in the Ann. des sciences nat., T. VIII, p. 304). Many Distoma develop from Cercariae, which can live freely in the water for a time, and these latter again develop from organized germ-tubes, provided in part with mouths, and intestines, which haven't the slightest resemblance to their young ones. (Nitzsch, Beiträge zur Infusorienkunde, Halle, 1817, Bojanus, Isis 1818, S. 129; v. Baer, N. Acta nat. curios, T. XIII, P. 2, p. 583; Carus, ebendas, T. XVII, P. 1, p. 87 and v. Siebold in Burdachs Physiologie, a. a. o.). The observations of Eschricht concerning the development of the tapeworms of Cottus scorpius, range themselves worthily alongside of these magnificent discoveries, which are the fruit and reward of a rare love and perseverance, proving in another way the congenerous generation of the entozoa. These worms cast off their masses of egg-bearing segments every year, while only the head which remains behind again grows new segments. Can one believe that this immense number of eggs which are formed anew every year, are destined to perish purposeless in the broad ocean? Interesting in another fashion is a fact, recently communicated by Miescher, that Trematodes occur epizootically in the feather coat of young sparrows (Beschreibung und Untersuchung des Monostomum bijugum, Basel, 1838). The worms can reach this spot easily from outside, and this is all the more probable as Miescher remarks, since the worms occur only in young birds and always in the hind quarters, thus in parts which in newly hatched eggs lie almost motionless at the bottom of the nest. After the death of the worms, their eggs remain in the fatty material filling out the feather coat, and could therefore, under favorable conditions, perhaps during incubation, attain development and pass on to a new generation.

cerning the nature of the contagion (and miasma) of the miasmatic-contagious diseases.

The infectious matter of the simple contagious diseases is not transient, or only to a relative degree. The course of the diseases is, mainly, not precisely typical.

In all other conditions however they agree with the miasmatic-contagious diseases, particularly in that their contagious matter acts in minimal quantities and multiplies in the sick body. According to our assumption then, living organic creatures should also be demonstrable among them as the cause of the disease and of the infection. These organisms would, however, have to differ from those which produce miasmatic-contagious diseases in that 1. they would not be transportable through the air, and 2. they would not die out after one generation, but would rather remain perennially in the same body and would be unrestricted in reproduction. Now let us see how far the facts confirm this.

1. They confirm it perfectly in scabies. Scabies is an inflammation of the skin, caused by the irritation of a species of mite, Acarus Scabiei, Sarcaptes humanus, which lives on the skin, or more correctly in passages in the skin. Every animal species has its particular scabies, mange, and their particular scabies insect. I may perhaps again indicate at this point how the differentiation of the contagious skin inflammations from others often depends only on the diagnosis of the causes. The scabies pustules or vesicles were also considered as a peculiar excretory organ of a morbid matter for a long time, and they were described more and more exactly in the hope of differentiating them from other accidental forms of skin inflammation, although it was known that tartar emetic produces an eruption very similar to that of scabies. Many pathognomonic signs have been cited, which can however be missing in individual cases, and only when fully developed is the exanthema of scabies still more characteristic in its location than in its form. Now that one knows the etiology of scabies, it is no longer a disgrace to admit that it is difficult to diagnose it differentially according to the form of the exanthema from other skin eruptions arising from internal causes, namely prurigo. One has a reliable means of convincing oneself that scabies, with a lesser degree of extension,

can often occur without the signs cited in the textbooks and that prurigo can occur with the characteristics of scabies. This also explains how it would happen that one saw scabies occur as the crisis of internal diseases, etc., without any contagion.

It is self-evident that the air is not a suitable means for transporting the scabies mite and its eggs. This epizoon can spread itself through the air as little as lice. Indeed, even continuous proximity to the scabious individual, and particularly at night, are necessary for an infection to take place, because the scabies mite is a nocturnal beast of prey.[64] If one considers further the equipment of mites, then it explains why by way of exception scabies infects the uninjured skin.

The following facts prove that the scabies mite however is not an accidental epizoon of scabious individuals, but is rather the actual contagious agent of scabies:

(*a*) Inoculation of the pus from scabies pustules does not produce scabies.[65]

(*b*) Scabies is cured by rubbing off the mites with brick dust and by searching for and picking off the mites. Sulphur, the specific remedy, also acts so reliably by killing the mites.

(*c*) Scabies cannot be transmitted by male scabies mites, but only by fertilized females. The male produces only a few vesicles locally, but no genuine scabies.[66] Scabies therefore becomes a generalized disease only by the reproduction of the mites. Their multiplication is infinitely unlimited and therefore the disease is chronic and does not heal spontaneously. On the contrary the Acari leave the body on which they live, if the latter suffers significant pathological changes (just as other epizoa do). The dermatitis ceases immediately and it can appear, as if the internal disease is a result of the cessation of the external one.

2. Morel de Vindé also ascribes the hoof disease of sheep to a small animal which nests in the claws of sheep just as the scab mite nests in the skin, and which he claims to have seen himself.

[64] Aubé, considerations sur la gale, Paris, 1836.
[65] Köhler, in med. Vereinszeitung, 1836, Nr. 9, 41.
[66] Hertwig in Gurlt and Hertwig, Magazin der Tierheilkunde, 1835, Heft 2.

Veith, who cites this,[67] doubts the fact but surmises himself that hoof diseases and mange are in a certain relationship to one another, since they often alternated with one another in the same individual and even occurred combined. Let us hope that the active zeal of the veterinary physicians, which is directed towards the physiological investigation of the disease, will soon elucidate this topic.

3. Syphilis. I do not speak about the venereal worms or insects which came up for discussion in the older authors, and are not observed but rather inferred.[68] Recently Donné [69] found microscopic animals, Vibrio lineola, in chancre pus; they also occur in syphilitic ulcers that have been produced by the inoculation of chancre pus (p. 11). These vibrios are supposed to be missing in gonorrheal pus and in that of bubos (p. 7, 39), and as Donné opines this pus should not produce syphilitic ulcers. Ricord's experiences however, contradict this, at least as far as the pus of bubos is concerned.[70]

Not only vibrios occur in the pus of syphilitic vaginitis, but also infusoria possessing a very peculiar form, Trichomonas vaginalis Donné; they are about twice as large as human blood corpuscles (1/120-1/50 mm.). Their body is often round, but can lengthen to various forms however, and is mostly elliptical with both ends pointed. At the one end the animal bears a very long, thin, simple, sometimes forked, whiplike appendix, which it moves in all directions, and at one side 3-5 fine cilia, which have a rotary movement, and as it appears, surround an oval opening. The other end is often irregular, sometimes however, if the animal moves, it stretches out to a kind of tail which appears to consist rather of a viscous, sticky fluid stretched lengthwise. Inside the body one differentiates irregular, dark points, among which some are often longer and more distinct. Not infrequently one sees the animals in groups with the posterior parts joined together. Usually they lie very still and move only the cilia, sometimes one also succeeds in perceiving a movement

[67] Veterinärkunde, Bd. 11, S. 93.

[68] Cf. Deidier, dissertation sur les maladies vénériennes, Paris, 1710.

[69] Recherches microscop. sur la nature des mucus. etc., Paris, 1837. Abstracted and reviewed, Ricord, mal. vén., pp. 58 ff.

[70] Donnés statement, that the pus globules of chancres and bubos are less distinct and regular than those of phlegmonous pus is not correct. Gluge has already objected to this (Anat. mikroskop. Untersuchungen, Heft 1, S. 28).

from one place to another. R. Froriep * also saw these animals in the otherwise healthy vagina of a girl who suffered from a syphilitic exanthema. I have rarely missed it in syphilitic discharges from the vagina. Finally I have also found conferva-like threads sometimes in syphilitic girls, if I scraped the mucus from the vaginal walls.

Facts are not lacking then, which excite the surmise that infection in syphilis results from animals or plants. One must nevertheless admit that all the observations cited are nothing less than demonstrative.

As far as the vibrios are concerned, they appear in a number of excretions and also in kinds of pus which are not of syphilitic origin. Donné himself admits having found them in benign balanitis (p. 8). He did not see them in other kinds of pus (p. 5); it is nevertheless a confirmed fact that they can occur at every spot where pus stagnates. On the other hand vibrios are missing in ulcers which are apparently of a syphilitic nature, like the bubos. Gluge missed them in chancres which are kept clean, and in pus, by means of which Richard produces syphilitic ulcers by inoculation.[71] One can therefore not even concede to Donné, that the vibrios could be used for the diagnosis of syphilitic ulcers, even if one did not wish to consider them as the contagion itself. It is still not improbable that Trichomonas vaginalis plays an important role in the contagious matter of syphilis. It is missing in the venereal ulcers of males and in the female vagina too; it is not found in syphilitic discharges. According to Donné (p. 27) it is not supposed to occur in the healthy vaginal mucus (epithelium); he did not examine benign pus and only in one case where the syphilitic character of the discharge was at the least very improbable, did he find the animal (p. 34). It is therefore perhaps only an entozoon of the vagina or an infusorium of the mucus itself.[72] Similar infusoria occur in the so-called matrix of the leech.

The same applies finally to the conferva-like threads, which I mentioned above. I also find them, mixed with vibrios, in the oral mucus which stagnates between the teeth, and between the epithelial fragments in the expectorated sputa of gastric conditions.

* Neue Notizen, Nr. 25.

[71] Op. cit., 28.

[72] It is easy to differentiate from the ciliated cells of the uterus by its form and its whiplike appendix.

4. Schönlein discovered a fungus[73] in the pustules of infectious porrigo and promised further communications on this subject. Only after this one will be able to judge whether the fungus is the cause of the pustules and therefore the contagious agent of the same or whether it is only a growth which luxuriates accidentally upon them.

These are all the facts which can be cited up to the present for the theory of the contagium animatum. Outside of scabies, infection through animals or plant has therefore not been proven positively anywhere, and I can add from my own observations, that I saw only the usual elements of malignant, putrid or even normal pus in the mucus of glanderous horses, which I had the opportunity of examining several times through the kindness of Prof. Hertwig, and in the pus of chancres and of gonorrhea. In infectious dyscrasias moreover no one thinks of an animate contagion in the usual sense.

However in the investigation of these contagia the same obtains as for the contagia of the miasmatic-contagious diseases, that the negative result is not entirely decisive, and the possibility remains further, for the former as well as for the latter, that the contagion is animate and indeed only an elementary part of the sick body, that it is relatively animate, as I called it previously. In considering the alternatives, whether the infective matter of the miasmatic-contagious diseases be absolutely or relatively independent, the former became more probable, because reasons argued for the fact that the infective matter could develop and multiply outside of the sick body. These reasons fall away in the simple contagious diseases whose infectious matter is just transmitted only from body to body now, and is formed anew in a single body under certain conditions. This, in connection with the negative result of the microscopic observations, could induce us to consider the contagion of the simple contagious diseases as a relatively independent matter, capable of being transplanted. If one admits the contagiosity of the dyscrasic products of cancer, of tubercles, etc., diseases belonging to this group are again divisible into two families of which the first still approaches the miasmatic-contagious diseases with respect to the properties of its infective matter; I include the syphilis, glanders, rabies, lung

[73] Müllers Archiv, 1839, Heft 1, S. 82.

plague(?) and hoof disease(?). Chancre poison, preserved in glass tubes, still showed itself to be active after eight days.[74] The contagia of glanders,[75] of rabies and of lung plague retain their power even in a dried condition as everyone knows. Among the diseases assembled here, most of them have this yet in common with one another, that nowadays at least they are not produced anew, but are rather always only transmitted from one body to another, a condition which is likewise still pretty compatible with the view that they owe their origin to an absolutely independent being. The contagion of the second family however (tubercles, cancer, condylomata, warts) differs from the infective matter also in the other respects, in which we recognized a similarity of the latter to the infusoria and fungi. While the infectious matter of the miasmatic-contagious diseases and also of the previously mentioned simple contagious diseases is the equal of the lowest animals and plant forms in vital tenacity, the contagia of this second family, for the most part, retain their activity only by the most immediate transmission, just like sperm and blood. From this it is already comprehensible why infection results so rarely in many of these diseases and mostly, although it is always the work of a moment, only after longer cohabitation, where the opportunities for the transmission multiply.

It is just these diseases which develop spontaneously in the well disposed body, and their hereditariness proves that the conditions for this can already be contained in the undeveloped germ. Their contagion develops in the course of a dyscrasia, while in the first family the dyscrasia does not precede the formation of the contagion, but rather follows it.

All simple contagious diseases or almost all have however this in common with one another that their infectious matters are decidedly not transient, like the contagion of glanders, and infect the individual only in closest proximity. For this reason the contagion of these diseases can never infect the air over wide areas and act as a miasma. Finally the cause of simple contagious diseases shows itself to be less independent in its temporal development, than the

[74] Ricord, traité pratique des maladies vénériennes, Paris, 1838, pag. 99.

[75] Hurtel d'Arboval, Wörterb. der Tierheilkunde, Aus dem Französ., Weimar, 1831, Bd. III, S. 510.

infectious matter; the course of the simple contagious diseases is mostly chronic and more or less dependent on the reactions of the diseased organism. The disease also does not protect against a new infection either during its duration or after it has run its course.

Appearances and Course of the Simple Contagious Diseases

I speak here only about the first family of the simple contagious diseases. An explanation of those diseases belonging to the second family, and which one can gather together under the rubric of infectious tumors, has already been attempted above (p. 45). Since they also arise from a dyscrasia, perhaps the scrofulous chronic inflammations of the skin, tinea and others, also belong to the same group, just as on the whole excrescences of the skin and the forms of inflammation of the same cannot be strictly differentiated from one another. The broad condyloma and the granulating chancre, indeed even a suppurating ulcer and a granulating one are forms of the same pathological metamorphosis, which slowly change into one another.

With the exception of rabies which shall be considered at the close of this section, the simple contagious diseases act just like the miasmatic-contagious ones with respect to the introduction and the first effects of the infectious matter, but the inflammation becomes chronic in the former partly because the development of the contagion is not circumscribed by such definite temporal limits,[76] partly because the disposition in the attacked body does not become exhausted by the disease, and finally, partly because normal regeneration does not easily start from the callous enclosure, which is formed by the inflammatory exudate in the connective tissue. Even benign ulcers with callous edges do not tend to heal.

It would be of great importance for our problem to understand clearly the relationship in which gonorrhea and chancre contagion stand to one another, since gonorrhea is so closely related to the

[76] Even the Stad. latentis contagii seems to be missing. According to Ricord (op. cit., p. 89) the characteristic chancre pustule develops from the moment of inoculation, and also in natural infection the red spot from which the ulcer arises, often already becomes noticeable a few hours after coitus.

miasmatic-contagious catarrhs in some respects. The view which was already opposed by Hunter and which has again become pretty much the general one, that namely the same contagion could transmit gonorrhea here and chancre there, received a new blow through Ricord. The experiments which he instituted in such variety and with such precision that they promise complete certainty, have shown that chancre permits of transmission by inoculation, while gonorrheal mucus however was always inoculated without success; therefore the poison of chancre and gonorrhea are not identical. The older observations which assume this identity, can only be used therefore with suspicion, and we learn nothing concerning the poison of gonorrhea, outside of the negative property, from Ricord's otherwise so valuable work. Ricord does not even consider it as a specific matter; he does not separate gonorrhea from other mucoid secretions resulting from irritation and associates the mucus with the irritating substances. According to this every mucus discharge would have to infect. Since this is not the case, then the gonorrheal mucus must have a special acrimonious quality which stimulates inflammation. Since however the secretion of the second transmitted inflammation is again not an ordinary mucus, but rather the same acrimonious mucus, then the reproduction of the specific acrimonious matter is not to be doubted and therefore it is a contagion.

The lung plague [77] is distinguished by the fact that no ulcers but rather tubercle-like tumors are formed in the infected lungs, which later give rise to suppuration and mucous secretion and again expel contagious matter with the mucus. The tumors can remain a long time without any noticeable symptoms of disease, and for this reason the period between the infection and the visible outbreak of the disease is very long, between 12 and 20 weeks. Its duration is indefinite, because the earlier or later occurrence of suppuration and of fever depends on many contingencies. The fever and even the visible disease can be assuaged for the moment and the disease appears overcome, and yet, despite that, the disintegration proceeds however and remains contagious. Without a doubt even these degenerated masses are not actual tubercles, but rather hepatised

[77] I follow the presentation of Sauter, die Lungenseuche des Rindvieha, ihr Wesen u. s. w. Winterthur, 1835.

areas of the lungs, fibrous exudations into the lung cells, which acquire the appearance of tubercles in that they are originally limited to single spots. Such local fibrous exudates are certainly called tubercles very often, and I believe that the controversy as to whether tubercles can or cannot be the result of inflammations, would soon be decided if one were agreed as to what tubercles are. Until now all isolated, gray or whitish, more or less rounded nodules of the lung and other organs are called tubercles. The microscope proves however, that such nodules sometimes consist only of organized coagulated fibrin, at other times of pus globules, and sometimes of true, peculiar elements, cells with a granular content. If one considers the latter alone as tubercles, then tubercles are never the direct result of inflammation.

In the simple contagious diseases the first symptoms also result therefore from the local action, and not from the introduction of the cause of the disease into the blood. In the further course however accidents occur, which give evidence of the passage of the contagion into the blood or lymph, secondary inflammations and abscesses, whose pus contains contagious matter, and in parts of the body, where this could only arrive at through the blood. I speak of the bubos in syphilis, the pus of which can't usually be inoculated, according to Ricord, and about the lymph and farcy tumors in glanders of horses. In both cases an infection of one part by another as it were takes place and the bearer of the infectious matter is lymph and blood. Both diseases, however, syphilis and glanders, differ in respect to the depth to which the humors of the body become infected. In syphilis the inoculation of the contagion cannot be demonstrated beyond the lymph glands. The blood, the secreted juices and the secondary suppurations and eruptions do not infect, and Ricord is of the opinion that the virulent properties of the chancre are immediately destroyed in the blood.[78] In glanders on the other hand the secondary inflammations which are produced through the medium of the blood, produce an infectious pus, and in conformity with this the disease can be inoculated by means of the blood itself, as well as through the juices prepared from it. Leaving glanders pus itself, which proved infectious in 43 experi-

[78] Op. cit., p. 162.

ments, out of the question, Viborg [79] inoculated glanders with the following materials taken from sick horses, with pus from the omental and intestinal lymph glands and from farcy ulcers, with urine, saliva, sweat and blood.[80] The vaporous exhalations from the nose, which were gathered in drops, were also inoculated successfully. In all these cases the inoculation occurred in the nasal mucosa; but the pus of glanders was also inoculated directly into the external skin and caused farcy vesicles (11.315). Finally glanders was also transmitted by the injection of blood from glanderous horses into the veins of healthy ones (11.335). The disease arose in the lungs first here, because the contagious matter was received by the systemic veins; farcy would have arisen, if it had been possible to introduce it directly into the pulmonary veins.

According to all this it seems as if the general dyscrasia which follows or accompanies the simple contagious diseases, is not founded on the same conditions everywhere. In lung "plague" the poison remains restricted very locally, the blood contains no contagion,[81] the general disease and death are the result of the pneumonia and suppuration and of restricted respiration. In glanders the disease becomes generalized, because the blood brings the infectious matter to all the parts, and here again experience teaches that the mucous membranes, glands, etc., do not prepare contagion from the blood, but rather that this is pre-existent in the blood and that the infection takes place from within outwardly as it were. Syphilis, whose contagion is received by the nearest lymph vessels and infects the nearest lymph glands from within outwardly, just like the poison of glanders, but which then disappears in the blood and does not again appear in the secondary suppurations, stands midway between both forms of diseases. In order to explain this, one would have to assume either that the chancre poison continues to exist further, also multiplying within the sick individual, but that it ceases to be transmissible, or that in the course of the primary syphilis the blood and the tissue suffer a transformation in the same manner, just as inanimate materials, metallic poisons, narcotics, etc., acting for a

[79] Über Rotz, Wurm und Kropf in his Sammlung von Abhandlungen usw., Bd. 11, S. 255, 111, S. 261.

[80] Op. cit., Bd. 11, S. 302, 326, 331, 334, 347, 111, p. 312.

[81] Sauter, op. cit., S. 127.

long time change the body so that with the neutralisation and removal of the matter itself the pathological reaction is not removed, but rather, with one word, dyscrasia is left behind. I would much rather support the latter view, if only because secondary syphilis like other dyscrasies is hereditary. Indeed it is also maintained that glanders is hereditary, but the opinions concerning this differ greatly, and very exact observers, among them Viborg, have declared themselves opposed to this hereditary view. Its defenders are however such, as Dupuy for instance, who do not at all consider glanders as a contagious disease, indeed not even as a specific disease, but rather as a form of strangles or of tubercle disease, and besides this, in addition, they make the mistake of confusing congenital and hereditary diseases. That glanderous mares foal glanderous young does not prove its inheritance, since in this case the disease is not caused by an unsound constitution of the embryo, but rather by an infection of the ripe fetus through the maternal blood.

Rabies

The contagion of rabies multiplies in the infected body, and in its development through the regular duration of the Stad. latentis contagii, also shows itself to be more or less typical. According to v. Walther this can be increased through intercurrent diseases, for example measles.[83] The contagion of rabies differs in this from the animal poisons and proves itself to be an independently animate matter. The contagion is fixed. It is however distinguished from the other fixed infectious matters in that it does not develop at the point of inoculation but rather in the blood itself. It approaches the plague matter in this respect and is a blood parasite of the lymph. The place of inoculation remains entirely indifferent. The inoculation wounds and the bites form scars and do not appear to take an important part even later when the disease breaks out. This is certain in dogs;[84] in man at the time of the outbreak of rabies the suppuration of the wound is supposed to become bad and the scar tender, as is generally reported. However probably every other wound and scar, not only the infected one, would behave so, since in deep affections of the nervous system every ulcer

[83] System der Chirurgie, S. 273. [84] Hertwig, op. cit., S. 171.

becomes worse, and under generally exciting influences, pain is always felt in wounds and fresh scars. I know from my own observation, that very superficial skin eruptions (eczema) still itch intensely and even smart under general excitement and overheating, even 2-3 weeks after scar formation.

That the contagion remains at the point of inoculation and is first absorbed later is an unproven assumption, which is already disproved by the fact that unless the destruction of the point of inoculation is undertaken at the beginning it does not protect against the disease any more. The question arises further, whether, when the poison of rabies reaches the blood, does it remain undeveloped until the time of the outbreak, or does it multiply slowly from the beginning and does the disease break out when it has increased to a certain quantity? The latter is more probable, because the duration of the Stad. latentis contagii varies too much [84] to be dependent only on the internal changes of the infectious matter. The sudden appearance of the disease is no objection; one sees also, how mercury in small doses can be tolerated for a long time and then excites salivation in a few days, how the attacks of lead colic appear rapidly and intensely, while the lead particles constantly accumulate in the organism for weeks and months.

Hydrophobia is a nerve disease, i. e. its most striking symptoms depend on changes in the central organs. However the cause of the changes in the nervous system is the abnormal constitution of the blood. The blood receives the cause of the disease and still contains it at the end of the disease, since it is infectious and communicates the contagion to the secretions, at least to the saliva.[85] The central organs are also not the only ones which feel the influence of the changed blood. Sometimes this part and sometimes that, pharynx, oesophagus, lungs, stomach, intestine etc., exhibit a kind of inflammation and during the disease they change its picture by their participation. In these viscera our knowledge is limited to the divergent qualities of the blood which they contain; our diagnostic means are not fine enough to find qualitative differences between

[84] Between 19 and 50 days in Hertwig's experiments. In human beings even greater differences have been found.

[85] Hertwig, op. cit., S. 113 ff.

hydrophobic (if I may say so) and typhous pulmonary or intestinal inflammations. In the brain it is different. The brain also suffers from congestion at the same time however attention is attracted by the reaction in a very specific manner, the peculiar type of delirium which corresponds to the quality of the sick blood. If a wine makes one morose, another merry and a third quarrelsome, if in chronic intoxications (in delirium tremens) rats and mice are imagined every time, etc., then it is not so astonishing that the specific poison of rabies produces definite pictures, appetites and delusive phantoms.

In this aphoristic presentation, which I do not elaborate further because I intend to return to the same topic in another place, I desired to show that the phenomena of rabies may easily be explained by the assumption that a specific matter, capable of reproduction, is mixed with the blood.

But what is the nature of this matter? We have no direct investigations concerning this, and the same manner of reasoning which has guided us until now, leads to unfathomable riddles. The disease arises not only through infection, but also spontaneously, just as Hertwig, whose opinion is probably the most important in this matter, testifies.[86] The spontaneous origin is however not a miasmatic one. Indeed older observations speak of epidemics of rabies in America, where even dogs on board ships become rabid;[87] nowadays however hydrophobia occurs sporadically at all times of the year and in all kinds of weather. The noxious influence can therefore not be mixed with atmosphere over wide areas; it cannot be spread by means of the air at all, since as a contagion it is at least not transient and does not even infect dogs in the immediate neighborhood of the sick one. It sounds very improbable[88] that, in all the cases where rabies broke out by itself, a fixed contagion, perhaps from earlier epidemics, had been acting upon them, and it is also therefore not to be conceded, because the poison does no harm if it reaches the blood in the usual ways, but only if it gets directly into the blood; further because only animals of the

[86] Op. cit., S. 28.

[87] Schnurrer, Chronik der Seuchen, Bd. 11, S. 382, 389.

[88] Despite the fact that very remarkable examples of the tenacity of rabies poison were cited. See among others Stark, allg. Path., S. 368.

canine species are primarily affected, since the contagion would also have to be taken up by other animals living under the same conditions if it existed as a finished product in creation.

Consequently the poison of rabies could find a place only in the group of the relatively independent matters; it must be able to reproduce itself in the body. This is also in accord with the supposition that, as one must indeed assume, it passes through the walls of the capillary vessels and appears in the secreted juices.[89] However the spontaneous disease occurs just like those produced contagiously, and since it progresses entirely like these, then, if we have concluded correctly until now, the matter of which it is the result, must have existed in the body before the outbreak of the disease; it must therefore be capable of forming in the apparently healthy body. Suppose one should even have to believe the tales (which one may certainly doubt yet) that vehemently irritated dogs, without being sick or becoming sick themselves, had communicated rabies to human beings by their bite?

I did not wish to conceal the difficulties which this disease opposes to my attempts at explanation. How heavily the doubts aroused here weigh in relation to the soundness of the empirical principles upon which our deductions have been constructed until now, depends upon the static moment. It must be left to the judgment of the reader who has followed me up to here to estimate this.

I may nevertheless refer to the fact that hydrophobia does not become more understandable under other assumptions which are possible at this time. Perhaps it will become so by continuous investigation of the facts in the manner which has been pursued so successfully.[90] However if one would finally have to admit that is to be judged from another point of view, then it does not appear doubtful to me which path one should follow. Should we give up the chemical researches which give us an insight into the action of the saliva, of the gastric juice and of the bile on the food, because

[89] See above, note 52.

[90] A question of great interest which could be decided experimentally, is whether the blood of inoculated animals already contains the contagion and infects through inoculation before the outbreak of hydrophobia or at the time of the premonitory symptoms. An affirmative result would at least prove that the body does not produce the contagious matter during the disease.

all chemical knowledge becomes a joke at the problem of how the sperm acts upon the egg? There was a time when one proceeded in this way, when one preferably compared saliva and bile to spermatic fluid which assimilates the undeveloped matter, which is capable of vivification, to the substance of the digesting body. The fruits which this method has born for physiology and practical medicine do not speak favorably of it.

Conclusion

It is a drawback which makes the theoretical consideration of our topic so difficult, that, namely, so few observations have been made and reported in such a manner that they could be used with confidence. There is hardly one assertion in the entire field, which has not been based upon experiences and has not again been disproved through experience. Under these circumstances one will advise the theory to wait until the experiences are more fully developed; however I believe rather, that in order for the experiences to develop they need the light of a reasonable theory. One is pleased with the joke that the theoretician wrings a favorable answer to his question from nature; but nature answers only when she is questioned, or more correctly, she speaks to us constantly and with a thousand tongues, but we hear only the answer to our question. There is only one pure experience, that is sensual perception; in expressing it we are already theorising; we separate that which is permanent, essential (subject) from that which is accidental (predicate). We learn only by comparison, however, what is essential among a number of predicates, and what is accidental and the result of the comparison expresses itself as a law, as a theory. One cannot choose to study nature theoretically or empirically but only whether one wishes to follow *one* theory consciously or whether one wishes to start from new, arbitrary assumptions after every new observation. The descriptive natural sciences already show how experience fares then. Why does it become absolutely necessary for everyone who arranges known bodies systematically according to new points of view, to study nature with their own senses, if not because others who started out from other view points, accepted heterogeneous things as identical and overlooked character-

istics, which have now become important? And if this happens with objects, where the chief thing is only to perceive constant characteristics by comparison, how much more do the opportunities for error increase, where changes in their relations to one another and external phenomena in their dependence on internal processes are to be presented. Even the physicians who are conspicuous as strict empiricists have not refrained from theories. Or does experience perhaps teach that critical molimina are a healing effort of nature, that the skin excretes the smallpox poison from the blood, and that brain disease, which manifests itself after the disappearance of an exanthema, is conditioned by the recession of the exanthema, etc.? These propositions are perhaps more than theory, they are opinions.

And should I finally demonstrate for those who estimate medical theories only according to their relation to medical action, that what one thinks about the nature of the contagion is not indifferent for therapy? It is easy to understand that the procedure against the local symptoms, the inflammation, the eruption, etc., in contagious diseases will be a very different one, depending on whether one considers them as the result or the cause of the more general phenomena. A traumatic inflammation may be cured, and the quicker, the better, while a symptomatic one should be cultivated because it is necessary for the body; one knows that it cannot be cured, or that if the cure succeeds, the disease breaks out in another, perhaps worse form. The contagious inflammations are symptomatic according to the usual view, according to our view traumatic. One example instead of many. According to our view chancre is originally a local disease, which, if it lasts for a longer time, produces a dyscrasia. The physician would then have nothing more immediate to do, than to prevent the chancre after the local infection, and, if this is impossible, to suppress it, as soon as it can happen. Ricord proceeds thus and his treatment is crowned with the best results. Why don't these experiences meet with a favorable reception? Only because according to an opinion which is believed to have been deduced from experience, the chancre is considered as a symptom of a general blood infection; contagion is supposed to reach the blood from the point of introduction and the syphilitic ulcer is

supposed to be the secretory organ of the morbid matter produced in the blood. Because of this the chancre should not be suppressed and not be cured without a simultaneous internal treatment; indeed one hears the prohibition altogether of the local treatment, since one believes to possess in the chancre a measure of the internal dyscrasia.

It should not become a principle that pathological theory anticipates therapeutic experience, but here it stands, supported in its turn by observed facts, facing an opponent of equal rank, a theoretical viewpoint. I hope I have succeeded, at least, in shaking the belief in the latter and in preparing the way for unbiased, collected experiences.

MEDICO-HISTORICAL ACTIVITIES IN THE UNITED STATES

MARYLAND

JOHNS HOPKINS UNIVERSITY, BALTIMORE
Institute of the History of Medicine

During the academic year 1938-1939, the following elective courses will be offered:

INTRODUCTORY COURSES

1. The History and Ethics of Medicine. DR. OLIVER. Tu., 4-5, one hour weekly during the academic year at Homewood, Remsen Hall 101.
2. Use of the Library. DR. LARKEY. First quarter. Hours to be arranged.

   The practical aspects of the resources of the Welch Medical Library; a brief survey of the scheme of classification; study of the various types of periodicals, indexes and other reference material. Informal talks arranged for small groups, who will be taken through the Library.

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3. Outlines of the History of Medicine. DR. SIGERIST. First and second quarters, Tu., 4-5.

   An introductory course, illustrated by lantern slides, with bibliographic demonstrations, chiefly for first-year students.
4. Medical History Seminar. DR. SIGERIST and staff. First and second quarters, Th., 4-5.

   A supplementary seminar to Course 3 for first-year students. In this seminar, the subjects presented in the lectures will be discussed with the students and opportunity will be given for further demonstrations.
5. History of Hygiene and Public Health. DR. SIGERIST. Third and fourth quarters.

   A lecture course, illustrated by lantern slides, with bibliographic demonstrations. The course will discuss the development of the leading ideas and achievements of hygiene and public health in their cultural setting.
6. Greek and Latin Terminology in Modern Medicine. DR. EDELSTEIN. Third quarter.

The purpose of the course is to examine the derivation and meaning of the Greek and Latin terms used by modern scientists, and to follow up the survival of ancient concepts.

Advanced Courses

7. The Aristotelian System of Biology. Dr. Edelstein. Third quarter, Tu., 2-3.

   It is intended to study Aristotle's biological works and the relation of his theories to those of his predecessors and contemporaries.

8. Aristotle and the Rise of Modern Biology. Dr. Temkin. Fourth quarter, Tu., 2-3.

   The course will be open to a limited number of students willing to do advanced work on the relation of Aristotelian thought to the history of modern biology.

9. History of Surgery. Dr. Temkin. Third quarter, W., 5-6.

   The course which will stress the development of surgery during the 19th century is intended for students of the third and fourth years.

10. Medical Monographs in China. Dr. Hume. Time to be announced.

    A study of Chinese monographs on infectious diseases, dietetics, diagnosis, treatment, etc.

11. Research Seminar. Dr. Sigerist and staff. Third and fourth quarters, Th., 4-5.

    The course is intended to make the students acquainted with the research methods of medical history. This year's program will be devoted to a comprehensive study of certain aspects of Greek medicine.

Sociological Courses

12. Medical Economics. Dr. Sigerist. Third quarter, W., 4-5.

    A discussion of the costs of illness and the costs of medical care and a study of the various systems of organized medical care (state medicine, health insurance, group hospitalization, health associations, etc.).

13. Sociological Seminar: Socialized Medicine. Dr. Sigerist and Dr. Larkey. Fourth quarter, W., 4-5.

    A discussion of the principles of socialized medicine and a study of their application to a definite area.

14. Current Events. Dr. Sigerist. First and second quarters, W., 5-5:30.

    Critical discussion of current events in the field of medical economics, social medicine, social insurance, etc. in America and abroad.

Study Groups

15. Study Groups in the History and Sociology of Medicine. Dr. Sigerist and staff, throughout the academic year.

    At the request of three or more students, the Department will organize special study groups to investigate and discuss definite problems of the history, bibliography or sociology of medicine.

The Johns Hopkins Medical History Club is closely connected with the Institute. Three to four meetings are held each year to which the students are cordially invited. See special announcements.

The Science and Social Relations Club, a student organization, will meet on two evenings every month in the Seminar Room of the Institute for discussions.